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ABSTRACT

Designed to supplement a short course for parents and their middle school children, this document provides organized, cooperative learning activities to be done at the zoo and at home. It is intended that the course be a vehicle for promoting positive attitudes toward the study of science in parents and their children and to increase their levels of awareness of animal behavior. The materials include information and activities to be used in conjunction with five sessions to be held at the zoo. The sessions deal with: (1) observing at the zoo; (2) learning in animals; (3) environmental pressures; (4) animal territories; and (5) the societal structure of primates. Each section of the guide that is devoted to a particular session includes an overview of the topic and descriptions of all of the teaching activities that occur at the zoo and at home. The appendices include bibliographies, selected articles, and additional optional activities. (TW)

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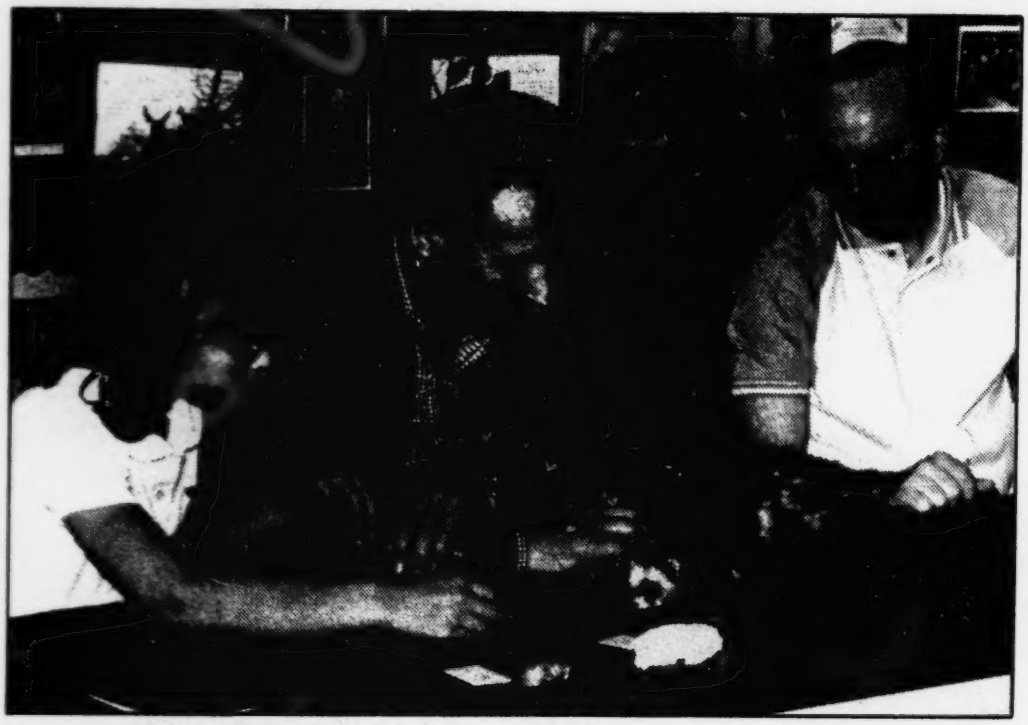

Animal Behavior

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A Course for Parents and Children

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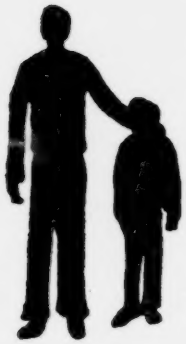
ANIMAL BEHAVIOR
FOR MIDDLE SCHOOL CHILDREN AND THEIR PARENTS



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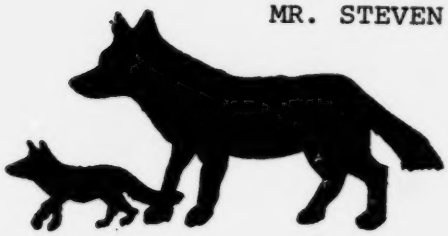

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Introduction

Humans have always been attracted to other animals - an attraction that has expanded in many ways with the passage of time. While for a long time the relationship between humans and animals was a predator-prey relationship, special relationships have been established between humans and a number of species. Humans with horses have traveled, hunted, and even participated in wars together. Humans and dogs in many societies have a very special relationship, forming bonds of mutual trust and respect and often appearing to have an intimate relationship.

Wild animals, though, continue to intrigue man. Man continues to search for and study animals in their natural habitats, as well as confining and observing them in zoos and aquaria.

During this course, parents and children are introduced to some initial techniques of observation, a sampling of both individual and social behaviors, and to the responsibilities and rewards for caring for a small mammal. Activities in the course were designed to achieve the following goals:

1. to promote positive attitudes toward the study of science in both children and their parents;
2. to increase the levels of awareness of animal behavior in both children and their parents;
3. to promote a positive parent and child relationship through a cooperative learning adventure.

Objectives for this unit precede each weekly session.

Cooperative Learning with Parent and Child

This course has been designed to provide an organized, cooperative learning experience where parents and their children can learn about animal behavior together at the zoo and in the home. While many families have pets, frequently we find that these families overlook the opportunities to learn from observing these animals. The concepts covered in this course are not only applicable to animals found in a zoo but also to those found in the home.

Advance Contact

We advise instructors to establish contact with class participants prior to the first class session. Class procedures, parking, etc. can be reviewed and home study animals described.

Facilities

Activities in this course require space which will allow for the demonstration and investigation of live animals. There should be access to zoo exhibits and behind-the-scenes areas.

Alternate Activities

Wherever an asterisk* appears, alternate activities or ideas have been suggested for your zoo. These can be found in Appendices 1-5. If an alternative to the gerbil as the home study species is selected, one should go through the home activity packets and revise them for your selected species.

Supplies and Materials

So that family members can learn together, it is most productive to provide equipment for each family when conducting activities in the class-

room. When possible, every effort should be made to use live animals in the classroom to demonstrate the concepts to be illustrated. The following materials should be ordered or planned for ahead of time.

1. The largest investment for this course will be the purchase of enough pairs of Mongolian gerbils or alternative animals so as to permit each family to have a pair of study animals at home. Breeding them in sufficient numbers is a more economical measure. In trial classes, cages, water bottles, shavings, and food were also supplied for each pair of gerbils. Gerbils and housing materials may be purchased from local supply houses or pet stores. Be sure to determine any limitations to the use of gerbils as regulated by your state or local laws, as well as investigating your zoo policies and quarantine procedures.
2. In Session II, you will need to provide the materials to build mazes. Most lumber dealers or hardware stores carry all the materials needed.
3. Session III requires the use of prepared skulls, small amphibians, or insects similar to cockroaches. If skulls are not available at your own facility, possible sources include nature centers, museums, or your local department of natural resources. If live amphibians and insects cannot be collected locally, they can be purchased from biological supply houses.
4. Session IV uses a film entitled, "Animal War, Animal Peace". One source for this film is: University of Minnesota Audiovisual Library Service
   3300 University Avenue Southeast
   Minneapolis, Minnesota 55414

   This session also requires the use of Siamese fighting fish (Bettas) and other small animals that help to demonstrate the concepts of territoriality and aggressions in animals. In trial classes, ferrets, porcupines, doves, and an iguana were used.
5. Session V has an activity which uses the film, "Baboon Behavior" as an option. This film should be ordered well in advance. It can be ordered from the same source as the film used in Session IV.

Session 1

Observing at the Zoo

SYNOPSIS

This first session will serve to introduce the participants to each other, to the Zoo, to the methods of observing animal behavior, and to the home-study animal. In this manual, the gerbil is used as the home-study animal.

It is possible that the participants may be attending from widely separated geographic areas while some may be well acquainted with each other. This first session is intended to serve as an opportunity for individual families to work together as well as families to get to know other families. Since some activities will be taking place at the Zoo, at times undirected, it is recommended that participants become acquainted with the Zoo site. Lastly, with the emphasis of the entire course on the observation and recording of animal behavior, some time will be spent on how best to make these observations.

MATERIALS

Name Tags

Pencils

Cut-out animal pictures, pins or tape

Pre-Course Questionnaires

Question bag and materials

Live animals to demonstrate in the classroom

Meter sticks

Gerbils in cages, bedding, food, and water bottles or preparation for alternative home-study animals.

Two containers per family (the cage for home use and one other)

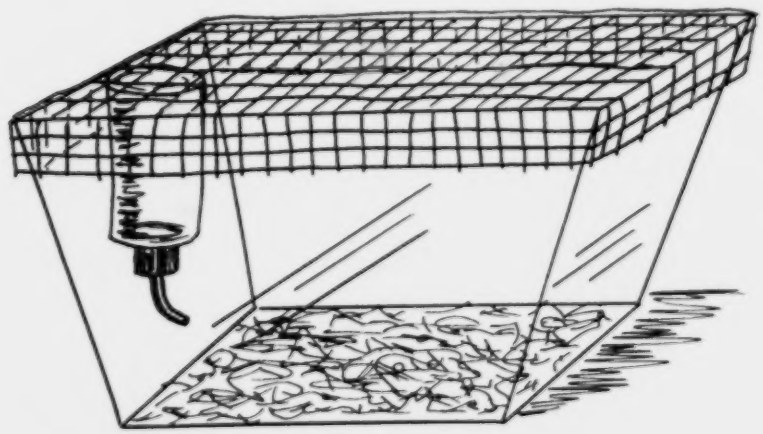
Handouts on gerbils

ADVANCE PREPARATION

1. Well in advance, order or begin breeding gerbils. Contrary to popular opinion, gerbils are not always easy to find. If you are breeding your own, remember that although the gestation period for gerbils is only 25 days, offspring should be approximately six weeks old before you send them home with the participants. These offspring will be ready to breed by the time they are 9-12 weeks of age.

   Place male gerbils in one container and females in another. This will insure that each family receives one gerbil of each sex.

   Unless your department is well stocked with "escape-proof" cages, order these for the participants to use. Don't forget a water bottle for each cage. Shavings and food, more than likely, can be secured from the animal management division of your zoo. If not, Purina "lab chow" and aspen shavings can be secured from local feed stores. Other sources of shavings are lumber mills and school wood shops, both of which often have shavings which they are willing to either sell or give away. Saw dust and shredded paper should not be used for bedding.



Housing for Gerbils

2. The animal pictures for the getting acquainted activity are cut out of old magazines and posters.
3. Obtain a "Question Bag" and collect materials.
4. Make arrangements to have live animals brought into the class for the observation activity.

TEACHING SUGGESTIONS

Getting Started: Introductions (20 minutes)

As the families begin to arrive, give each person a name tag with which to identify himself or herself. Then, without revealing what animals you have chosen, pin an animal picture on each person's back. Each one must then ask other people questions that can be answered by "yes" or "no" so as to enable each to determine what animal picture is pinned on his or her back. As each person thinks s/he knows what animal s/he has, request that s/he find a seat until all are seated or the allotted time has expired. Ask each person to stand and a) reveal what animal s/he believes s/he is, b) introduce another member of his/her family, and c) tell some interesting fact about that person.

Introduce yourself, giving a little personal background. Explain that the program is intended to be an enjoyable learning experience for family members.

Discussion: "Did You Ask The Right Question?" (5 minutes)

Point out that in the beginning exercise, some class members were able to discover what their animals were (give some of participant's answers). In order to do so, they had to ask good questions. This is what the study of animal behavior (or for that matter, any discipline) is all about: seeking solutions by asking the right questions.

Activity 1: "Question Bag" (20 minutes)

A further activity requires an object bag (pillow case, paper bag, or garbage bag). Items such as skulls, furs, shells, pieces of bark, or feathers are placed in the bag. Class members take turns selecting an object, keeping it out of sight by having their hand(s) remain inside the bag. They are asked specific questions by their partners about their selected object(s) until identification can be made. Questions requiring a "yes" or "no" are used. Examples of questions include: "Is the object hard or soft, rough or smooth, warm or cold?", "How heavy is it?", "How long is it?"

It will soon become apparent that good questions lead to answers. This should help reinforce the idea that the study of animal behavior revolves around asking good questions.

Activity 2: "Observation vs. Opinion" (15 minutes)

Objective: Given a set of descriptions about an animal, participants will be able to distinguish between observation and opinion in studying animal behavior.

Bring an animal such as a rat, tarantula, or lizard into the room. Ask the participants as a group to list all the observations they can about the animal in front of them. Accept all responses by writing them on the chalk board. Now ask participants which of these are actual observations and which of these are opinions. When studying animal behavior, it is suggested that participants be cautioned not to rely on opinion, but only to report actual observations. It is also very easy to become anthropomorphic when observing an animal's behavior. If this arises, you should spend some time discussing this problem and why we should avoid treating animal behavior in human terms.

Activity 3: "Qualitative vs. Quantitative" (30 minutes)

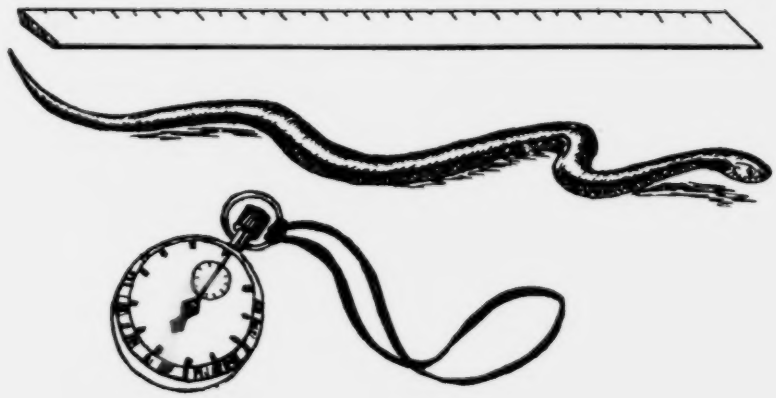
Objective: Participants will distinguish between qualitative and quantitative observations of animal characteristics and behavior.

Look at the responses on the board and have the group pick out observations which are qualitative (e.g., this animal is rough to the touch, has brown fur and pointed ears). Suggest to the group that sometimes it is very difficult to make quantitative observations out of qualitative ones. "For instance, take the case of roughness of fur. How could this be made into a quantitative observation?"

Explain to the participants that they will be divided into smaller groups. Each group will receive a live animal with which to work. The task for each group is to come up with 5 quantitative and 5 qualitative observations about its assigned animal.

Divide the group into units of three or four people. Give each group meter sticks and its own animal. In trial classes we have used snakes, gerbils, mice, or any animal that is small enough to be conveniently brought into the classroom. You may want to have a metric ruler and a scale available for those who wish to use them in making quantitative measurements. If some of the groups finish early, assign the additional task of finding five more of each type of observation. When all groups have finished the task, have each group share its discoveries with the class.

Typical responses for quantitative measurements may include: length, width, circumference, number of body parts, respiration rates, and heartbeat.



Two Devices Which Could be Used for Measuring the Speed of Snake.

Qualitative responses may include: texture, color, relative temperature, and ways the animal uses its body parts.

Activity 4: "Seeing the Zoo" (60 minutes)*

Objective: During the class participants will become familiar with the physical setting of the zoo facility and grounds and gain an understanding and appreciation of zoo concepts.

It is important for class members to be oriented to the Zoo. Provide them with materials developed as handouts for general visitors (maps, guides, calendars). Introduce them to the over-all zoo philosophy. Leave time for questions and answers.

Explain that each week the class will investigate selected areas of the zoo for their animal behavior studies and be provided with a special close-up look as part of the class.

Select the portion of the zoo that you wish to see this first day. As you guide the group members through the area, encourage them to make observations of the animals they see. Questions you might use include some of the following:

"How does this animal compare to the last animal we observed in relation to a particular behavior e.g. feeding, care of young, grooming, etc.?"

"What is an outstanding characteristic of this...(bear, snake, fish)?"

"Is that a qualitative or quantitative observation?"

"How would you quantify its movements?"

"Is that something you can observe or is it an opinion?"

Activity 5: "Meeting Your Gerbils" (30 minutes)*

Objective: Participants will demonstrate the proper method of handling gerbils and the ability to distinguish male from female gerbils.

The final activity of the day, after returning to the classroom, is to introduce the home study animals - gerbils - to the group. Show the participants how to catch, handle, and retrieve gerbils. Some members of the group may already have experience in this and are more than ready to share

their "expertise". Then ask if they can distinguish the male gerbil from the female. If they are unable to give good distinguishing characteristics, show them how to tell the difference between male and female gerbils.

Have one member of each family collect a cage, a container filled with shavings, a bag of pellets (lab chow), a water bottle, and a second, smaller container in which to carry home the second gerbil. Handouts on the care and natural history of gerbils are included with the home activity materials (see the following pages).

Since the gerbils have already been separated by sex, distribution of gerbils by sex will be made efficiently and will insure that each family receives a pair of gerbils. At this time, don't tell the group which is which, only that they will need to select one gerbil from each of two containers, one housing females and the other housing males. Have each family select two gerbils, each from a different container, reminding them to keep the gerbils separated in the containers they have for this purpose. Ask them which of the two gerbils is the male, which is female. The female should be placed in the large container to minimize possible fighting when the two gerbils are introduced to each other at home.

Home Activities - Observation (15 minutes)*

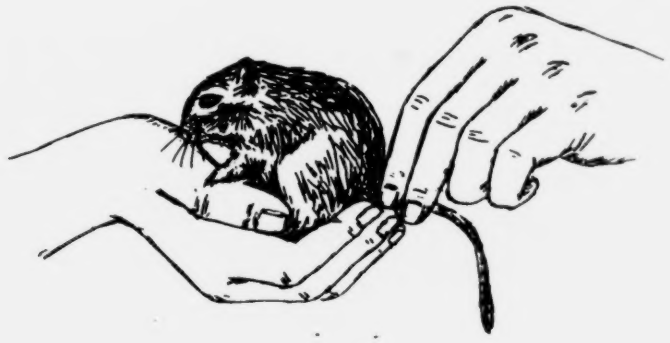
Pass out and explain the home activities. Participants should be encouraged to do as many of the activities as possible since by doing so they can greatly enhance the course experiences. The following week, have them take time to discuss the home activities (problems and rewards) and have each person fill out a questionnaire sheet on the home activities.

HOME ACTIVITY

SESSION 1

These activities have been created for you to do together at home. Allow enough time so that you won't have to hurry. This is intended to be a fun and rewarding experience - enjoy yourselves!

1. You now have two Mongolian Gerbils; one male, one female. Your gerbils have never met each other. Before you introduce them, pick up one of them (see picture).



Proper way to pick up and hold a gerbil

Approximately how heavy is the animal?

Can you tell which is male and which is female?

Describe the color of their fur. Of what advantage is it to the animal to have fur? If your gerbil is the normal color (tan), what advantage do you think it is for the gerbil to be this color? Are your male and female the same color?

How do they use their tails when they move? How is it helpful to the animal to have a long tail?

Look at your gerbil's feet. How are the hind feet different from the front feet? Describe how they use their feet, front and back, when they move and when they eat.

Concentrating on as many different body parts of the gerbil as you can, describe the movements the gerbil makes.

2. Now that you know your gerbils a little better, it is time to introduce them to each other. This is going to be an exercise in observation. First, put the cage in a quiet place so that the animals are not too disturbed by the sounds and activities of people. Watch very closely as you introduce your pair of gerbils and consider the following questions.

   Are their movements similar to, or different from, the movements you described earlier? How are they similar or different?

   Are they making sounds? If yes, describe the sounds. How are these sounds made?

   Are the male and female behaving similarly or differently? Describe the similarities and differences.

What senses do they seem to be using in exploring each other and their cage? How can you tell?

Do they fight? If yes, how do they fight? What events seem to start a fight? What stops a fight?

Which one seems to act more aggressively? How can you tell?

Why do some natural behaviors (such as digging) persist in this artificial environment?

3. Your first task in caring for your study animals is to set up an "animal care calendar" so that food, water source, and health can be checked every day -- whether morning, afternoon, or evening. It is up to you. Try to choose a time when you won't have to hurry, and when you and your other family member(s) can work together. If you do find that the food is gone, or the water has spilled, you must take time to set things straight.

   We have included a calendar on which you can set up your schedule and check-off system.

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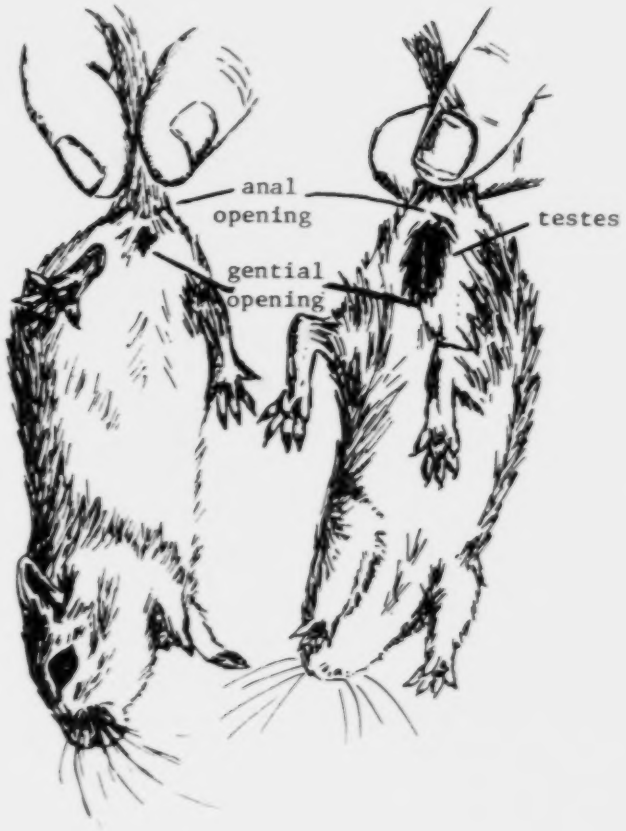
   We have included a calendar on which you can set up your schedule and check-off system.

MONTH _____ 19 _____

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
25						26

GERBIL CARE HANDOUT

Your pair of gerbils belong to the species Meriones unguiculatus, the Mongolian gerbil. As the common name suggests, these animals are native to the region of Mongolia. Their natural habitat is very dry and sandy. There, they live in "herds," digging extensive burrows called "galleries." In the wild, Mongolian gerbils eat grain seeds such as millet and buckwheat; in the spring and summer their diet includes the leaves of these plants.



female male

Gerbils

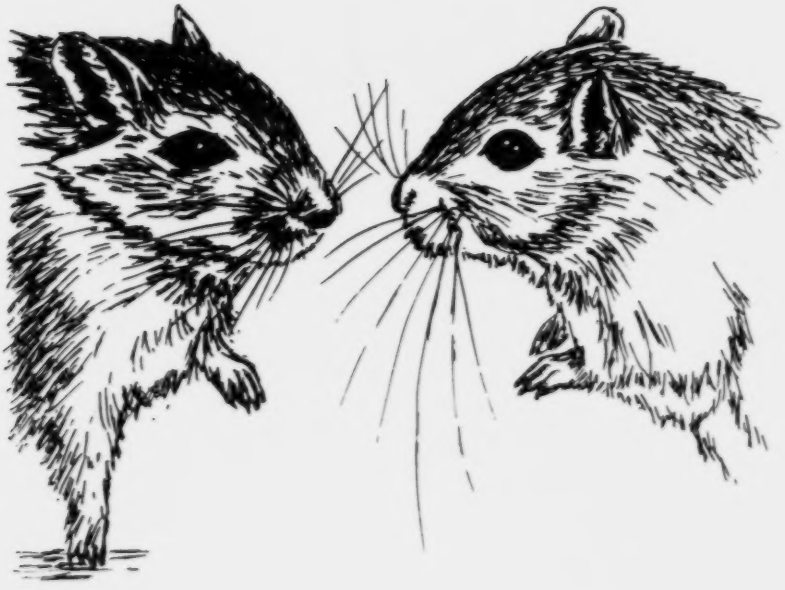
Gerbils have a system of water metabolism that allows them to get all their needed water from their food. However, because pellet food is extremely dry, you shold give your gerbils water each day. Or, you can give them lettuce and celery to provide necessary moisture. Gerbils also have very dry feces, and urinate in very small quantities; this decreases their water losses and helps them get by without drinking a lot of water. Because their wastes are so dry, you will not have to clean your gerbils' cage any more often than once each month, unless the water spills. Do not feed meat or candy to your gerbil.

Gerbils are capable of breeding year round. They form monogamous pairs (one male, one female) to mate. The pair remains together throughout their reproductive life. In the wild, gerbils live about two years; in captivity they live up to three years. You can tell the sexes apart by comparing the relative distance between the anla and genital openings. This distance is shorter in females than in males. (See diagram) Females become receptive to mate (come into estrus) every 4 to 6 days. The "preferred" time to mate is between 6:00 p.m. and 8:00 p.m.

You may well be having a birthday party! The gestation period, the time from mating until birth of the young, is 24 to 25 days. The average litter size is 5 (litter size ranges from 1 to 12). Delivery lasts about two hours. Both the

male and the female care for the young. The babies are born blind and helpless, and remain with their parents until they are 4 to 5 weeks old.

Provide your gerbils with litter (wood shavings are fine), bedding (soft cloth) for nests, and some "toys" (wooden blocks, metal running wheels, paper towel tubes) on which they can exercise. Then, all you need to do is supply them with food and moisture, step back, and enjoy the company.



REFERENCES FOR GERBILS

Kimbrough, T.D., and G.C. Llewellyn. 1973. Evaluating the Impact of the Environment on Metabolic Rates. American Biology Teacher, 35:265.

Robinson, D.G., Jr. 1974. Twentieth Anniversary of Tumblebrook Gerbils: Some Historical Notes. The Gerbil Digest 2(1). Tumblebrook Farm, Inc., Mass.

Robinson, D.G., Jr. 1975. Gerbil Care and Maintenance. The Gerbil Digest 2(2).

Robinson, D.G., Jr. 1976. Ecology of the Mongolian Gerbil. The Gerbil Digest 3(2).

Robinson, P.F. 1959. Metabolism of the Gerbil, Meriones Unguiculatus. Science, 130 (3374):502.

Thiessen, D., and P. Yahr. 1977. The Gerbil in Behavioral Investigations. Houston: University of Texas Press.

Walters, G.C., J. Pearl, and J.V. Rogers. 1963. The Gerbil as a Subject in Behavioral Research. Psychological Reports, 12:315.

The Mongolian Gerbil: Natural History, Care, and Maintenance

Maryanna F. Fisher
Gerald C. Llewellyn

DURING THE SHORT TIME it has been in the United States, the gerbil has become an increasingly popular animal. Its pleasant disposition and cleanliness have made the gerbil a good pet, and its other qualities make it an excellent research animal. This article will discuss the gerbil species most commonly available in the United States—*Meriones unguiculatus*, or the Mongolian gerbil.

The genus *Meriones* was first described by Illiger in 1811. The Mongolian gerbil, or clawed jird, was first identified by Milne-Edwards in 1867. Its scientific name, *Meriones unguiculatus*, has an interesting translation. Meriones was a Persian warrior-god who wore a "battle helmet adorned with boar tusks." The species name means "clawed" (Robinson 1975a). It is quite a ferocious title for such a docile little animal.

The species is native to the area in and around Mongolia. It arrived in the United States in 1954 when eleven pairs of gerbils were obtained from the Central Laboratory for Experimental Animals in Japan to begin the first breeding colony. Dr. Victor Schwentker, who recognized the need for better laboratory animals, was directly responsible for the acquisition of the gerbils. Schwentker founded Tumblebrook Farm, which became a breeding and supply center for these animals (Robinson 1974).

Use in Research

The usefulness of the Mongolian gerbil for research is not a recent discovery. As early as the 1880s, Metchnikoff, a Russian bacteriologist, used *Meriones* in his research on tuberculosis (Robinson 1974). In 1933 the gerbil was used in an attempt to eradicate bilharzia, a form of schistosomiasis found mainly in the world's rural areas. The gerbil was used in further research on bilharzia during the 1950s and 1960s, especially in Egypt where the disease afflicted 75% of the population (Schwentker 1974).

Gerbils have a wide range of susceptibilities and some notably unique characteristics. They have been used in research with bacterial, rickettsial, and viral diseases, as well as in cancer research and related cytological diseases because of their susceptibility to these diseases (Robinson 1976a; 1977). Because they do not develop *otitis media*, an inflammation of the middle ear that other laboratory animals seem to contract, and because they exhibit a wide auditory range, gerbils are good subjects for auditory research (Daniel and Loesche 1975).

The gerbil has a unique fat metabolizing mechanism that can take the smallest amount of fat and store it. They are excellent subjects for cholesterol studies because they develop high blood serum cholesterol levels in response to dietary cholesterol (Schwentker 1963).

Genetic studies have also been conducted with the gerbil. Gerbil family members are similar externally and anatomically, but their chromosomal count has a wide range from 40-72. The Mongolian gerbil has 44 chromosomes (Wahrman and Zahavi 1955).

The gerbil's high degree of heat tolerance, great capacity for temperature regulation (Robinson 1950), and high resistance to radiation (Chang 1964) make it useful in research on the effects of these variables.

The gerbil has found its way into psychological studies as well. Because they are extremely curious, gerbils are

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FIGURE 1. The gerbil can be held in cupped hands or by the base of the tail.

well-suited to behavior studies. They also surpass rats in the acquisition of a discriminated avoidance response in the Skinner box (Walters 1963). Research in territorial behavior has also been conducted with gerbils (Thiessen and Yahr 1977).

Natural History

The sterile conditions of a laboratory are quite different from the gerbil's native surroundings. The following observations on the gerbil's natural history were made by Kasuga of Kitasata Institute, Japan, and translated by Nomura (Schwentker 1974). The Mongolian gerbil lives in a very dry, sandy land, typical of Mongolia's inner regions. It lives in herds in a burrow referred to as a gallery, and is active day and night. Because large numbers of gerbils live in the gallery, six or seven openings lead down a slanting path into the ground. The gallery is about 4 cm in diameter and is spread over 3 to 4 meters. There are many branches and levels, with a round nest made of soft leaves in the center of the gallery. One or two large cylindrical areas near the nest are used to store food, which consists of buckwheat, millet, and other grain seeds. The seeds are stored for winter from September to March. During the spring and summer, gerbils eat the young leaves of these plants.

Behavior and Characteristics

The gerbil's size is between that of a mouse and a hamster. Adult males average about 80-90 grams in weight; females weigh from 70-80 grams. Their total length is usually from 21.0-24.5 cm. Gerbils have dark brown backs and lighter brown sides, with gray undercoats. Their undersides are white. Their eyes are dark and protrude slightly and their ears are small and narrow. Gerbils are docile and will seldom bite. Because they are curious, they have few fears. They are quiet animals; their tiny squeaks occur only during adolescence, courtship, and fights. Gerbils make a drumming sound by thumping their hind legs rapidly on the cage floor, but this is usually only a warning signal or a sign of excitement. Their activities are cyclical: burrowing, eating and grooming, alternated with rest periods. Their activity usually peaks after midnight. It is interesting that the activity cycle can be altered if the light-dark cycle is reversed.

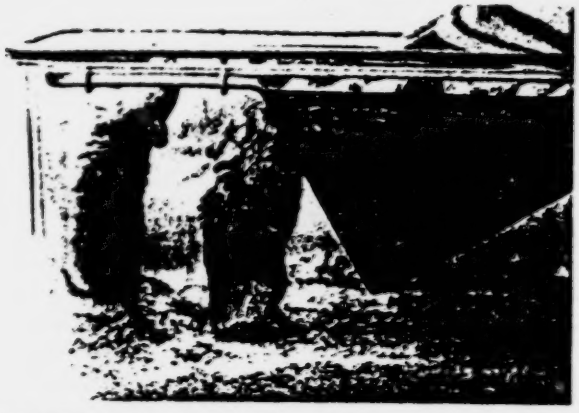


FIGURE 2. Gerbils are active day and night—eating, burrowing, playing and grooming.

Care and Maintenance

Gerbils are easy to care for and maintain, and this has been their ticket into homes, laboratories, and schools. They adapt readily to varying environmental conditions and have few requirements. Gerbil cages can be bought from manufacturers, but standard plastic or metal mouse or rat cages with solid floors are equally satisfactory. An inexpensive cage can easily be made at home. It should have a minimum height of 15 cm because gerbils often assume a semi-erect posture. A cage with 1,161 square centimeters of floor space is adequate for breeding a pair and a litter (Robinson 1975b). The 1975 edition of the Department of Health, Education, and Welfare's *Guide for the Care and Use of Laboratory Animals* recommends that a hamster weighing from 60-80 g should be housed in a cage 15 cm high with a floor area of 84 cm. The average weight of gerbils falls within this 60-80 g range, so a cage of this description would also be appropriate for housing a gerbil. Gerbils are gregarious, but care should be taken to avoid overcrowding. When gerbils begin to bite each other at the base of the tail leaving a bare spot, it is a sign that they need more space (Robinson 1975b).

Gerbils can tolerate temperatures ranging from over 37°C to below freezing (with adequate bedding). A comfortable temperature range is from 21-22°C, but exact control is not necessary. The amount of light available is

not important either; twelve hours of light is generally sufficient to encourage breeding. Humidity is a more important factor to consider. Because gerbils live in a naturally dry area, their fur stands out and may appear matted when the relative humidity exceeds 50%. This is not a critical condition however, and may even be caused on occasion by the water bottle leaking into the cage (Robinson 1975b).

Gerbils eat a variety of foods. Commercial rodent pellets are easy to obtain and suitable for gerbils. A gerbil colony will consume an average of 5 g per gerbil per day. Weanlings should be started on grains or seeds because they find it difficult to eat hard pellets. Gerbils may become too fat if they are fed on a diet of high fat content seeds, such as sunflower seeds. Fat deposited around the ovaries may interfere with reproduction, and adult males tend to add considerable body weight, especially after 24 months of age.

Water, which is extremely important to most other animals, is not as critical to the gerbil's well-being. Gerbils have a unique system of water metabolism that takes water from the foods they consume. In their natural habitats, they need no water because of this ability, but in the laboratory because of the low moisture content of pellet food, water should be provided. Fresh greens, such as lettuce, can be used as water substitutes. Going a few days without water will do little harm to gerbils, but experience indicates that water should always be made available to caged animals. Gerbils that have lost 10-20% of their body weight because of water deprivation will appear healthy, yet when they are examined ventrally the weight loss is more obvious. Their fur tends to camouflage weight loss. Animals on a tryptophan-free diet have lost up to 40% of their weight and returned to normal when placed on a regular diet. Diets containing mycotoxins and dimethylforamide also inhibit the rate of weight gain (Hastings and Llewellyn 1973; Llewellyn 1975; Llewellyn *et al.* 1974).

Cleaning the cages of laboratory animals is usually considered a "necessary evil." Because gerbils drink little water they excrete only small amounts of urine. Their fecal material is small and almost dry. Both urine and feces have little odor. Wood shavings and cedar chips, about 2-5 cm deep are generally used for bedding. Absorbancy is not a problem so whatever material is the most easily available and least expensive can be used. Bedding should be changed once or twice weekly. The easiest way to do this is to remove the gerbil from its cage by picking it up by the base of the tail. It can be held in cupped hands or set in the palm of one hand while the tail is being held in the other. Special care is necessary with young gerbils who may jump suddenly and fall to the floor. Gerbils are active animals and can jump as high as 30 cm and execute a broad jump of 60 cm (Robinson 1975b). Because they are curious, they are easily recaptured if they escape.

Breeding

Breeding gerbils is easy. They are monogamous; the female will seldom accept a new mate if she loses her first one. Sexual maturity is not reached until 10-12 weeks, but the testes may descend as early as the 35th day and the vagina may open at 45 days (Schwentker 1963). If they are paired when sexually mature, the female gerbil may reject the male's advances and even try to kill him (Robinson 1975b.). If gerbils are paired at about 8 weeks, however, there will be fewer rejections because they will have matured sexually together. Distinguishing between the male and female is sometimes difficult. Scrotal pouches are not always easily distinguishable on the male. Perhaps the best indication of "who's who" is the placement of the genital opening—it lies closer to the anal opening in the female than in the male. Gerbils breed throughout the year. Their gestation period is about 25 days. The female exhibits a reproductive condition known as *post partum estrus*; she is fertile again almost immediately after giving birth. Sixty percent of pregnancies occur at this time. Litters average 5 and usually 7 litters are produced over the 20 months of reproductive life (Robinson 1975b).

Gerbils in the Classroom

The gerbil's many characteristics make it an ideal animal for the science classroom. Its unique physiological qualities offer interesting topics for student investigations. The gerbil's natural history and ecological relationship with its environment would mesh well with a study of ecosystems. Water and food consumption studies, as well as behavioral studies, could also be undertaken by students. Gerbils fit into most metabolism chambers for oxygen consumption studies (Kimbrough and Llewellyn 1973). Having students care for animals provides a lesson in animal care, and at the same time, keeps the cages clean during the school year. Gerbils can be a valuable addition to any classroom.

References

CHANG, M. C., HUNT, D. C., and TURBYFILL, C., 1964. High resistance of Mongolian gerbils to irradiation. *Nature* 203(4944):536.

DANIEL, H. J. and LOESCHE, P. J., 1975. The gerbil as a subject for auditory research. *The Gerbil Digest* 2(4). Tumblebrook Farm, Inc., Massachusetts.

HASTINGS, W. S., and LLEWELLYN, G. C. 1973. The effect of aflatoxin B_1 on growth rate and iron metabolism in juvenile Mongolian gerbils (*Meriones unguiculatus*). *Environ. Physiol. Biochem.* 3:213.

KIMBROUGH, T. D., and LLEWELLYN, G. C. 1973. Evaluating the impact of the environment on metabolic rates. *American Biology Teacher* 35:265.

LLEWELLYN, G. C. 1975. Sterigmatocystin toxicity in three rodents, *Mesocricetus auratus*, *Meriones unguiculutus*, and *Mus musculus*. *Dev. Ind. Microbiol.* 16:343.

_____., HASTINGS, W. S., KIMBROUGH, T. D., REA, F. W., and O'REAR, C. E. 1974. The effect of dimethylforamide on female Mongolian gerbils, *Meriones unguiculatus*. *Bulletin Environmental Contamination Toxicology* 11:467.

PECKHAM, J. C., COLE, J. R., CHAPMAN, W. L., MALONE, J. B., McCALL, J. W., and THOMPSON, P. E. 1974. Staphylococcal dermatitis in Mongolian gerbils. *Laboratory Animal Science* 24(1):43.

ROBINSON, D. G., JR. 1974. Twentieth anniversary of Tumblebrook Gerbils: some historical notes. *The Gerbil Digest* 1(1). Tumblebrook Farm, Inc., Massachusetts.

_____. 1975a. Gerbil class and nomenclature. *The Gerbil Digest* 2(1). Tumblebrook Farm, Inc., Massachusetts.

_____. 1975b. Gerbil care and maintenance. *The Gerbil Digest* 2(2). Tumblebrook Farm, Inc., Massachusetts.

_____. 1976a. Susceptibilities of the gerbil: bacterial, rickettsial, and viral. *The Gerbil Digest* 3(1). Tumblebrook Farm, Inc., Massachusetts.

_____. 1976b. Ecology of the Mongolian gerbil. *The Gerbil Digest* 3(2). Tumblebrook Farm, Inc., Massachusetts.

_____. 1976c. Gerbil genetics. *The Gerbil Digest* 3(4). Tumblebrook Farm, Inc., Massachusetts.

_____. 1977. Cancer Research with gerbils. *The Gerbil Digest* 4(1). Tumblebrook Farm, Inc., Massachusetts.

ROBINSON, P. F. 1959. Metabolism of the gerbil, *Meriones unguiculatus*. *Science* 130(3374):502.

SCHWENTKER, V. 1963. The gerbil—a new laboratory animal. *Illinois Veternarian* 6(4):5.

_____. 1974. *The gerbil—an annotated bibliography*. West Brookfield Laboratory, Massachusetts. Tumblebrook Farm, Inc.

THIESSEN, D. and YAHR, P. 1977. *The gerbil in behaviroal investigations*. Houston: University of Texas Press.

UNITED STATES DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE, PUBLIC HEALTH SERVICE, COMMITTEE ON REVISION OF THE GUIDE FOR LABORATORY ANIMAL FACILITIES AND CARE OF THE INSTITUTE OF LABORATORY ANIMAL RESOURCES. 1972. *Guide for the care and use of laboratory animals*. Washington, D.C.: Department of Health, Education, and Welfare.

WAHRMAN, J. and ZAHAVI, A. 1955. Cytological contributions to the phylogeny and classification of the rodent genus *Gerbillus*. *Nature* 175(4457):600.

WALTERS, G. C., PEARL, J., and ROGERS, J. V. 1963. The gerbil as a subject in behavioral research. *Psychological Reports* 12:315.

Session 2

Learning in Animals

SYNOPSIS

Participants will contrast inborn and acquired behavior in animals. The focus in this session is on acquired behavior (learning). Participants are introduced to the topic of "learning" as they attempt to decrease the amount of time it takes for them to perform a sorting activity. Participants are then shown learning programs that are being used at the zoo with marine mammals, birds, and other animal groups. They begin in class the construction of a maze which will be used with their gerbils at home. During the next few weeks the gerbils will be taught to run through the maze in the shortest time possible and to perform a simple task. The following exercises are examples of trained behavior controlled by an experimentor. There are, however, many examples in an animal's environment where learning takes place without apparent reward. For background information, see the appendix to this session.

MATERIALS

Decks of playing cards (one deck/family) or 3" X 5" note cards

Maze materials - per family unit

2' X 2' (71 cm x 71 cm) of peg board

5 dozen #10 box nails

2' X 2' (71 cm X 71 cm) plexiglass

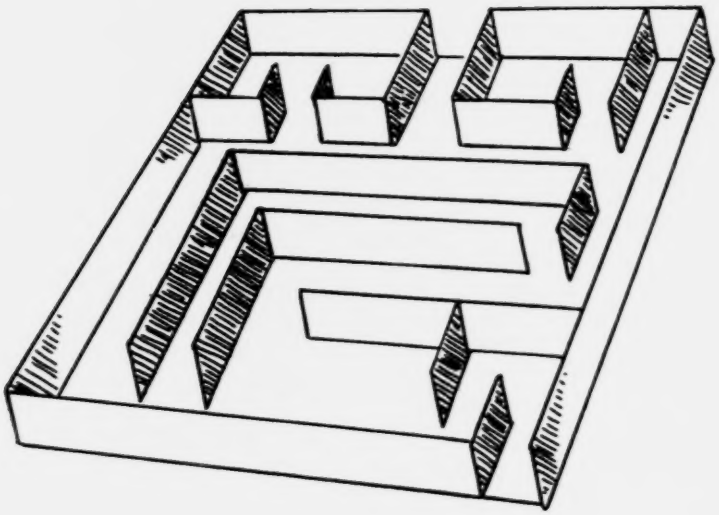
2' X 2' (71 cm X 71 cm) corrugated cardboard

Pair of scissors or knofe to cut cardboard

ADVANCE PREPARATION

1. You will have to purchase hardware for mazes. Pegboard and plexiglass will have to be cut to size. Each group can assemble its own maze.

A completed example is useful for participants to see.



2. We have found that laboratory animals, especially rats are easily trained and can be used to demonstrate what can be done to train animals. We have taught rats to run mazes, climb ladders, walk a rope bridge, and take a cover off a styrofoam cup in order to reach its food. Additionally, goldfish, paradise fish and cichlids have been trained to swim through hoops under water, to take food out of an eye dropped held slightly above the water level and to respond to a whistle cue. All of these animals take 4 to 6 weeks of consistent daily training to become dependable. Practice, Practice, Practice! From time to time we have also been fortunate enough to have imprinted birds at the zoo which can also be used during this session.

3. If there is a difficulty in observing live training programs at your zoo you may want to secure video tape or slides of animal training at your own facility.

TEACHING SUGGESTIONS

Home Activity Review (15 minutes)

An inquiry as to how their week went with the gerbils generally leads to some informative sharing of suggestions for everyone. Ask, "Have you set up an animal care calendar?" "Do your gerbils fight?" Use this time to solve any problems families may be encountering with their home-study animals.

Getting Started: Discussion of Learned and Inborn Behavior (20 minutes)

Objective: Participants will be able to give examples of learned and inborn behavior in animals.

Explain that animal behavior is sometimes divided into two varieties--that with which an animal is born (inborn or innate) and that which it learns (acquired). Ask participants to give some examples of learned behavior in animals. A whale or dolphin jumping through a hoop or a pet being taught to perform a trick are examples of this type of behavior. Then ask participants to give examples of inborn behavior in animals. Instinctive and reflex behaviors fall into this category. Psychologists feel there are few instinctive behaviors in man - the sucking instinct is thought to be one - while reflex behaviors such as eye-blinking in bright light may be more common. (See Appendix 2 for background information.)

Activity 1: Learning (30 minutes)

Objective: Given an activity which requires learning, participants will be able to discuss the value of practice in helping a person perform a task (positive transfer) but also the hindrance that practice can provide in performing a similar task (negative transfer).

Habits are considered a form of learned behavior. Ask the participants what habits they have observed in themselves. Point out an observable habit in an exhibit animal. In trial classes the path worn by the snow monkeys (Macaques) around the perimeter and across the middle of their

exhibit has been used as an example. Explain to the participants that they are going to participate in a habit formation activity.

Distribute a deck of playing cards to each family (or give 52 index cards to each family and ask them to put a "+" on 13 cards, a "-" on 13 cards, an "0" on 13 cards, and an "X" on 13 cards). Tell them to place two strips of masking tape to form a large + on the table or desk in front of them. Have them tape down one of each variety of cards in each of four spaces made by the crisscrossed tape.

Then give the following instructions: Shuffle your cards thoroughly. One member of each family is to sort the cards as quickly as po-sible into four piles - one pile of "+'s". The other member(s) of the family is (are) to time how long it takes to sort the cards. Pick up the cards and keeping the cards taped in place, shuffle the cards thoroughly and repeat the sorting for at least three or more times or until there is no change in time.

Ask, "What causes the decrease in the time that it takes to sort the cards?, and "What is the reward to you?" (Getting a faster time). It is well known that practice may improve a person's performance.

Immediately do the following activity to show that practice may also make it more difficult to perform a similar task. Take the taped cards and move them clockwise 90°, tape them in place, shuffle the cards thoroughly and, while timing, again sort the cards as quickly as possible. Ask, "What causes the increase in time?" In most cases, timing will again increase because participants will have a tendency to throw the cards the way s(he) had been doing it. This interferes with the new requirements of the rotated cards.

In animal training programs, it becomes essential not to change the program. The animal becomes confused just like you probably did when the taped cards were moved clockwise.

Activity 2: Trained (conditioned) Behavior*

Objective: Given appropriate demonstrations of animals which have been involved in a learning program, participants will see the value of an appropriate reward for the animal being taught, and describe how a learning program is initiated and implemented.

1. Beluga and Dolphins (60 minutes)

If many examples of animal learning and training are not readily available at your zoo, you may want to supplement the activities below with video tapes or a film. In trial classes, we observed the zoo whales during their daily training periods (which are initiated both to exercise the animals and to keep them "mentally alert", and similarly, we observed the dolphins). After seeing these programs, we invited the sealife curator to answer questions about how the beluga whales and dolphins are trained. A brief description of the training program of the belugas is given on the next page.

Five times a day these marine mammals are put through a series of conditioning activities which reinforce several natural behaviors and permit the trainers to have the belugas perform on cue. Behaviors exhibited on cue include breeching, spy hopping, retrieving objects using echo location, and vocalizing. If the belugas, Anana and Nukaluk, perform correctly they receive a food reward such as smelt or herring. However, if their response is incorrect, the trainer strikes the edge of the pool with a rod and this sound indicates to the whale that they have not responded properly and therefore, will not receive a reward. These same techniques are used in the training program for the bottle-nosed dolphins found at the zoo.

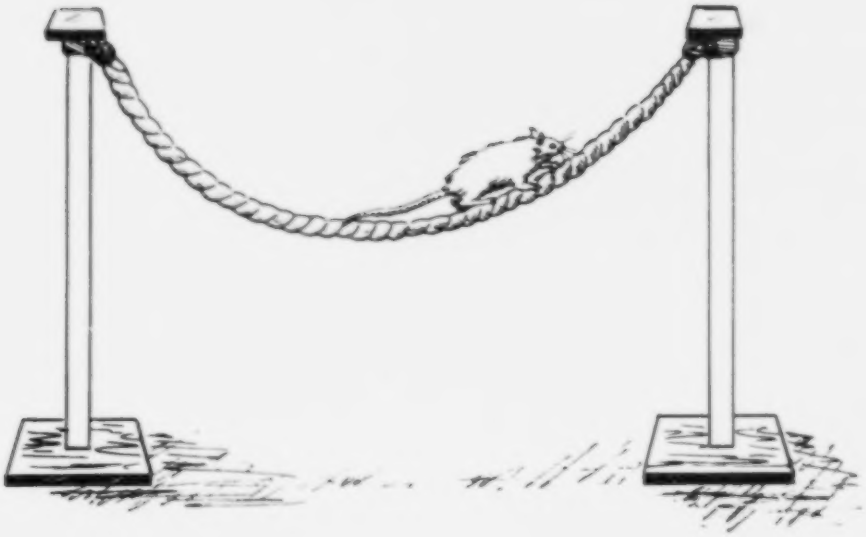
Breeching

2. Birds (20 minutes)

In trial classes, we invited the trainer of the performing birds to demonstrate in the classroom how the birds of prey, parrots and a raven are trained to show natural learned behavior such as hunting, retrieving, flying, and mimicking. In these instances, these birds are also rewarded with appropriate food. If they do not perform correctly, food is withheld until the correct response is given.

3. Other Animals (20 minutes)

We also have demonstrated how a white laboratory rat has been conditioned to climb a ladder, walk a tight rope, and take a piece of food from the instructor's hand. Additionally, goldfish and convict cichlids have been conditioned to go through a hoop placed in the water and to take brine shrimp directly from an eyedropper held over the surface of the water in their tank.



Discussion: Gerbil Trick (15 minutes)

Objective: Participants will be able to teach their gerbils a "trick" (task).

During the next four weeks, tell the participants you want them to teach one of their gerbils to perform a trick. Remind them that it probably would take a great deal of time, effort, and patience to get their gerbils to perform a complicated trick (like going through a hoop) but that if the trick is not too complicated, they can easily be taught. Ask "What will you use as a reward?" Food is the usual response. Then ask, "Might there be some special food that your gerbil would especially like that would cause him to learn (to be conditioned) more quickly?" Ask, "What kinds of tasks (tricks) do you think your gerbil could learn?" Tell them that on the last day of class you would like them to discuss with or, if facilities permit, to show the rest of the class what their gerbils (or alternative study animals) have learned.

Home Activity - Learning: Mazes (20 minutes)

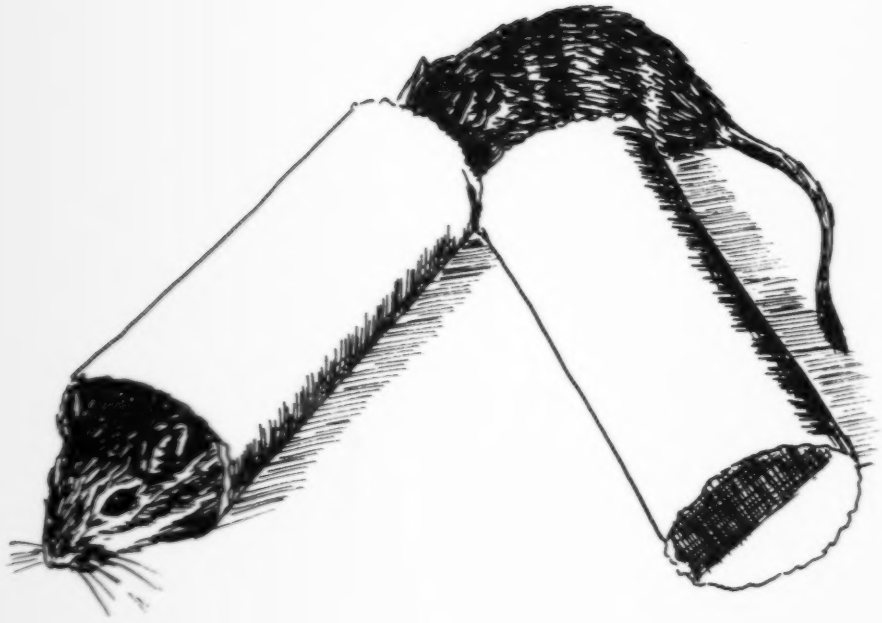
Objective: Given an example of a maze constructed for gerbils, participants will be able to institute a training program with the use of a reward to teach one of their gerbils to go through a maze in the shortest time possible. (For other study animals consult alternative home-study packets.)

Ask, "What is a maze and what is it used for?" Show them the maze that you constructed and mention that researchers are interested in trial-and-error learning and have sometimes used mazes to get this information. Explain that a maze is simply a testing device which gives the experimental animal, in this case the gerbil, a number of paths to choose, only one of which is correct and leads to the reward such as food. Tell them that the maze you have is called a multiple T-maze. Ask, "Why is it called that?" Explain that the gerbil comes to an intersection, one turn leads to a blind alley, the other turn leads to another intersection where the gerbil must again choose between right and left while it completes the maze and is rewarded.

Mention that most people who drive to work and try to find the best route to take to get there in the shortest time possible with the fewest lights and bottlenecks use thinking similar to that required in going through a maze. Ask, "What is the reward to the driver?" Tell them that it will be useful to keep track of how fast their gerbils learn by using the charts and graphs similar to the ones that are included in the home activity. Take time to briefly explain the chart and both the time and error graphs. Begin construction of the maze in class so that everyone knows how it is done.

HOME ACTIVITY

SESSION 2



How fast can your gerbil travel through a maze? After constructing a maze, questions you will need to consider before starting a training program for your gerbil(s) is what will you use as a reward, and will you use one or both in your training program? Once you have taught your gerbil to go through the maze, you could find out if one gerbil is better than another in running through the maze, whether one kind of food is better than another, does time of day make a difference, does having just eaten make a difference, etc. Planning an experiment to test your gerbils might be very challenging -- and fun!

MATERIALS YOU WILL NEED TO CONSTRUCT YOUR MAZE

One 24 X 24 inch piece of peg board (81 cm x 71 cm)

Optional but helpful: one 24 x 24 inch piece of plexiglass (71 cm x 71 cm)

Five dozen #20 common nails

One piece of corrugated cardboard cut into strips 3" wide (8-10 cm)

PROCEDURE:

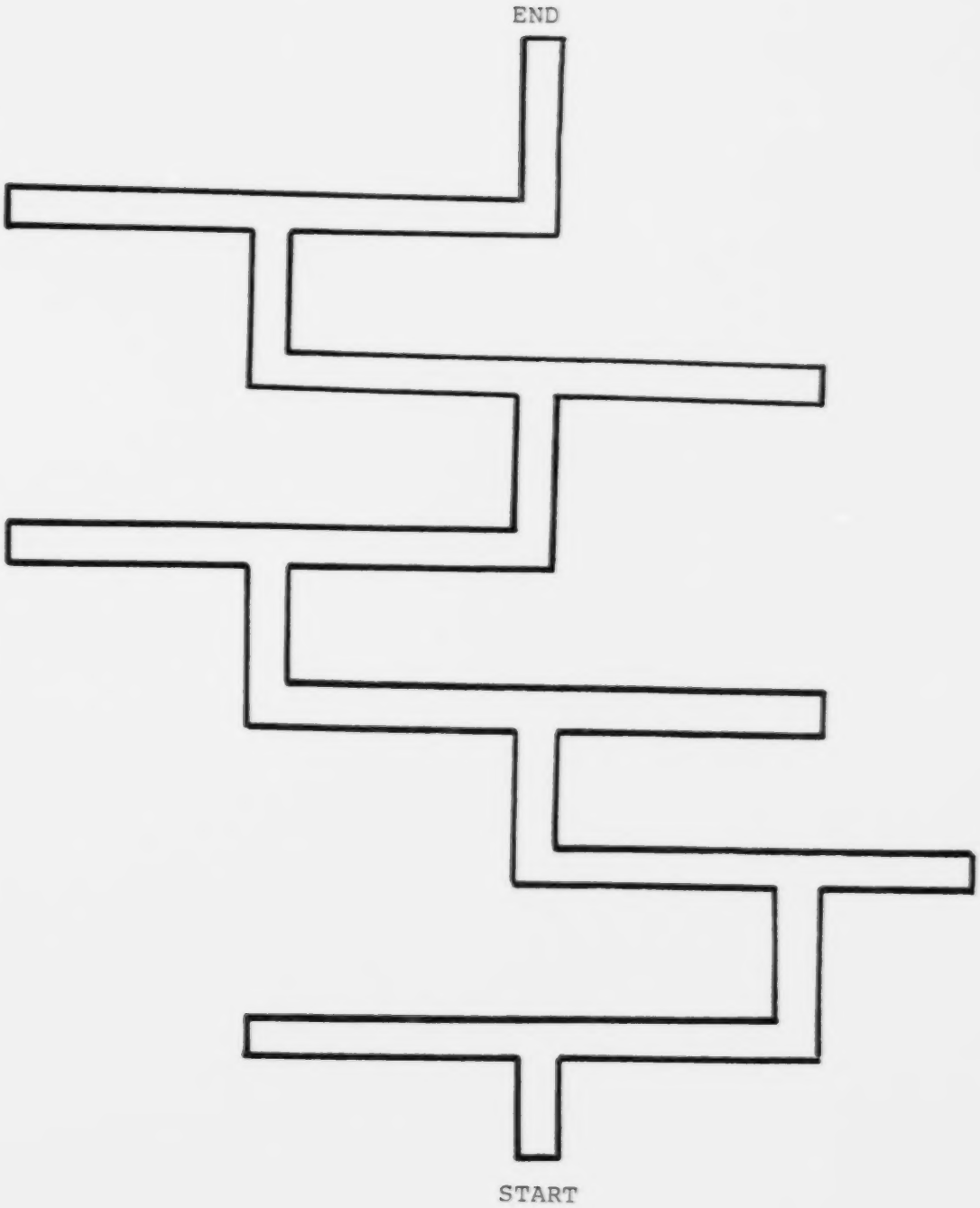
Draw a diagram of a T-maze you wish to construct, including at least 5-6 intersections. An example is included on the following page in order to aid you in your creation.

Following completion of your maze on paper, transfer the design on a peg board by placing the nails into every 3rd hole. Be sure to place the rows of nails far enough apart to give your gerbil enough room to move.

To form the walls of your gerbil maze, insert nail points between the front and back pieces of the corrugated cardboard. Leave an entrance and exit open.

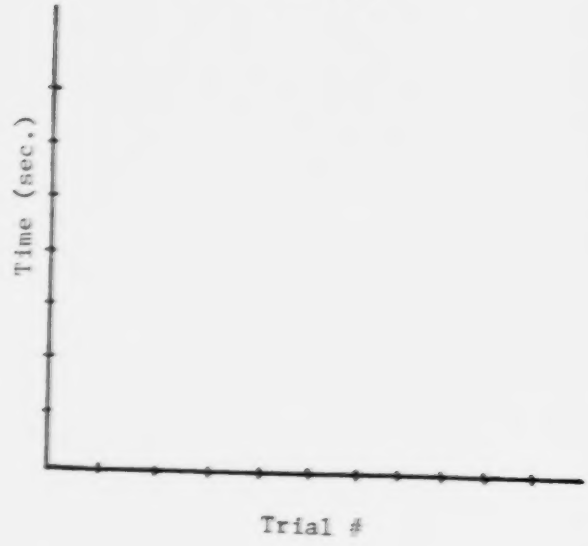
You may wish to use masking tape to secure the cardboard walls to the nails. Place the sheet of plexiglass over the top of your maze and you're ready to go.

Example of a Multiple T-maze (6 T's)

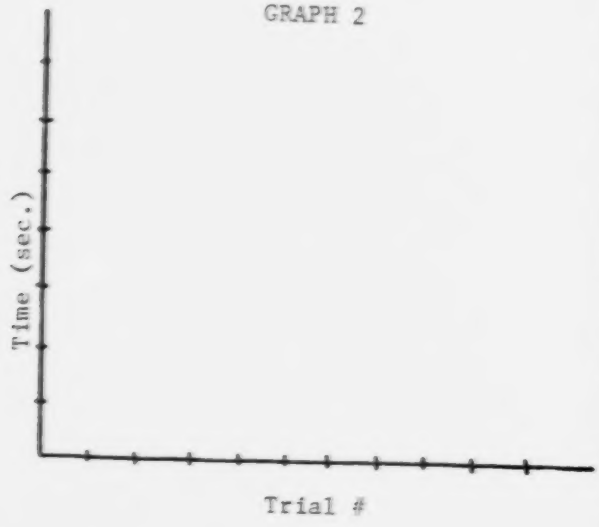


TRIAL #	TIME (SEC)	ERRORS

GRAPH 1



GRAPH 2



1. How long did it take your gerbil to go through the maze with no errors?

2. Where did the fastest learning take place?

3. Where did the slowest learning take place?

Session 3

Environmental Pressures

SYNOPSIS

This session will be spent examining the behaviors exhibited by animals in response to external pressures found in their environment. One such pressure is predation. The differing behaviors of prey and their predators will be studied. Another pressure that will be examined is the reaction of animals to a change in temperature in their environment.

MATERIALS

Live animals for demonstration - In trial classes a ferret (carnivore), rabbit (herbivore), and opposum (omnivore) were used to demonstrate predator/prey relationships.

Eight to ten representative skulls of herbivores, carnivores, and omnivores

Frogs and/or cockroaches (2-3 of each)

Racetrack or arena (see advance preparation)

Stop watches

Meter sticks

Fifty "moths" - 25 white and 25 black cut from construction paper (5 moths per class member)

Tape

Copies of article, "How Do they Make It Through the Winter?"*

Home activities

ADVANCE PREPARATION

1. Locate skulls of herbivores, carnivores, and omnivores. Attach numbered tags, keyed to a master list, to each skull. Make copies of worksheet 1: Skulls.

2. Arrange to have a zoo staff member bring in several live animals or secure them yourself prior to the start of the session.
3. Cut out 50 "moths" (25 out of white construction paper and 25 out of black construction paper). Tape the construction paper moths around the classroom, making sure some are placed on white backgrounds and some are placed on black backgrounds.
4. Make a "racetrack" for the cockroaches. Mark off a piece of cardboard or wood (approximately 20 cm x 100 cm) in centimeter increments. Take two more pieces of cardboard the same size and form side walls for the racetrack. A shorter piece of cardboard held across both ends of the track will keep the cockroaches enclosed. If you choose, place a piece of clear plastic or plexiglass over the top to make the participants more comfortable with the cockroaches.

TEACHING SUGGESTIONS

Home Activity Review (10 minutes)

Ask, "What were some of the problems, if any, you encountered working with your gerbils during the past week?" Some participants may still have difficulty distinguishing the male from the female. Others may have questions about feeding or how to capture an escaped gerbil.

Also ask, "What are some of the benefits of families working together?"

Getting Started: Discussion of Environmental Pressure (15 minutes)

Objective: Participants will be able to characterize the environmental pressures existing, for selected animals, both in their natural habitats and in a zoo setting.

Ask, "What are some factors in the environment which exert pressures on animals (i.e., affect whether they survive or not)?" Several possibilities might be suggested such as lack of food, hunting, whether the animal has shelter, the weather, etc. Further ask, "Can you give some examples of specific animals and how they respond to any of these pressures?"

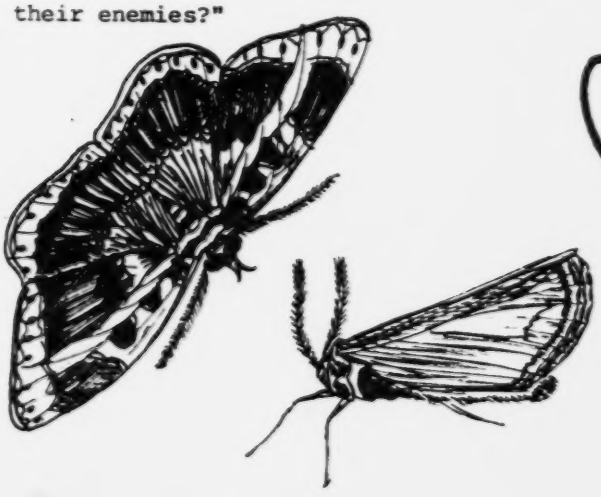
Explain that in this session they will be investigating only two environmental pressures. One is the pressure that an animal experiences from lack of food and the other pressure to be explored is that caused by temperature changes in the environment.

Activity 1: Competition Game (20 minutes)

Objective: Given classroom activities, participants will be able to identify the effects of competition of animals for food.

Ask, "What happens to animals when there is a scarcity of food?" After accepting responses from participants, ask them to pretend that they are birds whose survival depends upon getting enough of a particular species of moth for food. These have been hidden around the room prior to the participants' arrival. To begin, instruct the participants to work as family units collecting as many moths as they can find. Each moth discovered must be brought back to the home base (seating area) prior to collecting another. Any family with five moths for each family member at the end of a five minute period has survived for the day.

Ask participants, "In the case of the moths, what characteristics are important for their survival?" (Color or camoufalge - it may be that you can point to one of the moths which was not found by the participants.) "What other ways do prey have for escaping from their predators?" Some responses might include being swift, having good haring, rolling into a ball, etc. Ask, "Can you give examples of animals that use these means of escaping from their enemies?"



50 Pattern for Moth Cut-outs

Activity 2: Skull Identification (30 minutes)

Objective: Given representative samples of skulls from animals which are herbivores, carnivores, and omnivores, participants will be able to determine which are predators and which are prey and determine feeding adaptations.

Using a skull for demonstration, ask, "How could you determine if the animal from which it comes probably was a predator (hunter) or prey (hunted) animal?" Some responses might be the kind of teeth it has, eye position, etc. Ask, "What can you tell about the animals by studying these skull characteristics of animals?" If the responses below are not given, suggest these possibilities.

1. Teeth may allow you to determine what the animal eats.
2. Eye position in the front of skull allows you to determine if the animal has binocular vision. Animals which have binocular vision often are predators. Eye position on the side of the head gives better than 180° field of vision. Animals which have eyes on the side are often prey.

Focus in on the teeth and show how it is possible to determine what kind of food the animals eat by looking at their teeth. Have children look at their parent's mouth and parents look at their children's mouths to identify teeth types. Carnivores (meat eaters) have pronounced canines for ripping and tearing and sharp cheek teeth (molars and premolars) for shearing meat and crushing bone. Herbivores (plant eaters) have pronounced incisors and smooth molars for cutting and grinding vegetation. Omnivores (eaters of plants and meat) usually have modified canines, molars and incisors.

Carnivore Skull

Place 8-10 numbered skulls at various stations around the room. Hand-out Worksheet 1 "Skulls" to each family. Have each family move from station to station answering the questions about each skull.

WORKSHEET 1

SESSION 3

SKULLS

SKULL #	What kind of teeth does it have?	What might it eat?	Carnivore? Herbivore? Omnivore?	What might the animal be?
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

After twenty minutes ask the participants to return to their seats. Allow each family to share some of their decisions about each skull when you hold it up in front of the class.

Demonstration: Live Animals (15 minutes)

Objective: Given time to view several animals, participants will be able to identify other physical characteristics of herbivores, carnivores and omnivores.

Use any live animals which would demonstrate a typical predator/prey relationship or you may wish to visit an exhibit. In trial classes a ferret and rabbit were used.

Begin by discussing predation and asking what characteristics of the ferret (or other predator animal you select) allow adaptation to its role as predator. Then follow this discussion by using the rabbit (or other prey animal you select) and asking what characteristics allow it to escape from its predators. Answers will probably include claws and other anatomical features, abtivity patterns, etc.

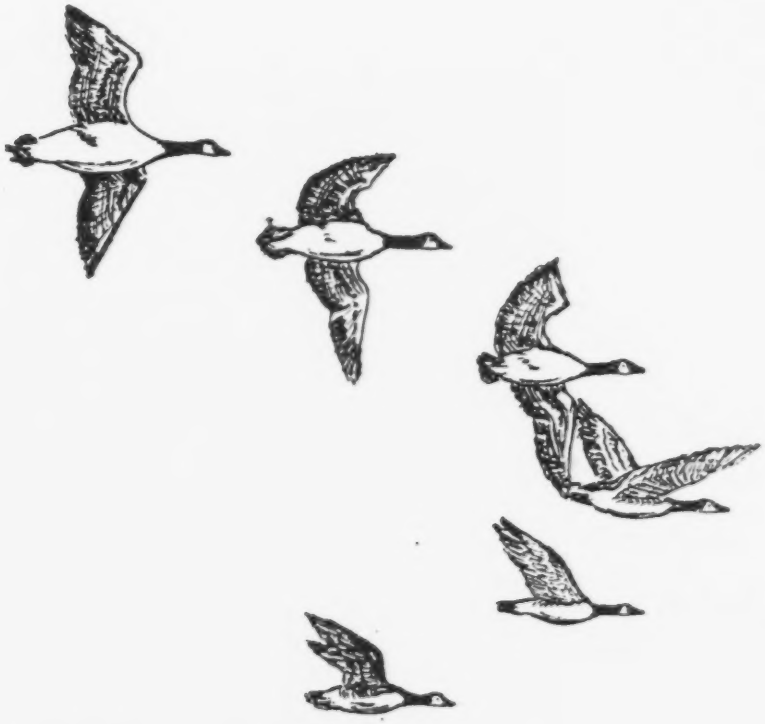
Allow the group members to share any knowledge they might have about the animal. Other questions might include: "What other types of animals would compete with this particular animal for the food it eats?" or "How is this animal adapted to its environment?"

Ferret

Discussion: Theromoregulation (15 minutes)

Objective: Participants will be able to identify adaptations possessed by some animals which enable them to survive temperature extremes.

Ask the participants, "How do animals cope with extreme temperature variations in their environment?" Possible answers might include the adaptations associated with migration, hibernation, dormancy or estivation. In trial classes, "hibernation" was most frequently mentioned. The discussion that followed centered around clarification of these different methods of survival. Help the participants to distinguish among the four methods of survival listed below:



Migration

a. migration - to pass periodically from one region or climate to another for feeding and/or breeding.

b. Hibernation - to pass the winter in a sluggish or resting state.

Hibernation

c. dormancy - to pass the winter in several periods of deep sleep rather than in complete hibernation.

d. estivation - to pass through warm and/or dry periods by some adaptive measure such as dormancy or a hibernation-like state.

In trial classes we chose to consider the means by which animals can survive during the northern winter. Questions to use in the discussion might include:

a. Give some examples of animals which migrate, hibernate, or become dormant.

b. How does hibernation differ from dormancy?

c. What advantages are there in each of these methods of survival?

d. What disadvantages to an individual animal might there be in each of these methods of survival?

e. What other means of survival are employed by northern animals?

f. What would happen to the wildlife if there were a severe winter?

Demonstration: Chilly Amphibians and Insects (10 minutes)

Objective: Given time to measure activity levels of some animals at both normal and cold temperatures, participants will be able to identify some of the physical effects of cold temperatures on amphibians or insects, such as cockroaches.

Spend several minutes watching frogs or salamanders, making quantitative observations of behaviors and activity levels such as breathing, etc. Alternately, run cockroach races in a track you have previously constructed. Once again make quantitative measurements of activity levels by timing with stop watches or measuring the distance of movement with meter sticks. Explain that while the group takes a walking tour in the zoo, the animals you have been working with will be chilled in the refrigerator. Suggest that they not subject any animals to this treatment at home. Ask the group to predict what changes will occur in the activity levels of the animals. List them on the board. Proceed to the on-site tour.

Upon returning to the classroom, see if participant predictions were accurate by again measuring the activity level of the animals that were used in the beginning of this section. What is the advantage to the organism in slowing down its breathing rate, movement, etc. as the temperature falls?

On-site Tour: Animals That Must Survive the Winter (45 minutes)

Objective: Given viewing time of various adaptations of zoo animals, participants will be able to determine the anatomical and behavioral features various animals have for protecting themselves from predators and surviving changes in temperature in the environment.

Take a short tour of the zoo specifically looking at animals which are adapted for escaping their predaotrs or coping with temperature changes in their environment.

Questions which might be directed toward the group include:

a. How does this animal protect itself from predators?

b. How is this animal's body adapted to its environment?

c. What kind of temperature fluctuation is this animal subjected to in its environment?

d. How do these animals survive the winter?

e. What would happen to this animal if the temperature of its exhibit were lowered by $10^{o}F$, $20^{o}F$, $60^{o}F$?

Home Activity: Environmental Pressure (5 minutes)*

Hand out the home activity sheets. Encourage the families to feel free to modify or expand on the suggested home activities. Caution them to not attempt anything that would endanger the life or health of their gerbils. "When in doubt, don't!"

Also have the participants read the article "How Do They Make It Through the Winter?" by Anne LaBastille, National Wildlife, December 1977, Vol. 16, pp. 20-25.

Explain that next week they will be investigating animal territories and how animals communicate the existence of their territory.

HOME ACTIVITY

SESSION 3

ENVIRONMENTAL PRESSURES

What are some of the environmental pressures gerbils may be sensitive to?

Within the limits that you can observe, how do changes in temperature influence the behavior of your gerbils? Consider using hot water bottle or a tray of ice cubes under the cage.

Do their movements and postures change when the temperature changes? What positions do they take when they are warm?

Do they use their nests differently at different temperatures?

How do they behave when there is a lot of moisture available? What happens when you "mist" the inside of the cage with a plant sprayer? What else could you use if you don't have a plant sprayer?

How sensitive do you think gerbils' noses are? How could you find this out? What roles would you expect "chemicals" to play in a gerbil's environment?

From looking at your gerbils (shape, size, etc.) and their behavior, how would you describe their natural habitat?

In their natural home, water is very scarce. How is the gerbil adapted to this dry climate?

Session 4

Animal Territories

SYNOPSIS

In this session participants will study animal territories and how territories are defended as well as determining the advantage for securing a territory. Live animals will be used both in the classroom and the zoo to investigate the means by which animals establish their territories.

MATERIALS

Live animals

Home Activity Questionnaire

Three ringdoves (a male and female pair plus a single male), porcupine, ferret

Betta splendens in individual tanks (Two for each two families)

Cichlasoma nigrofasciatum in two 20-50 gallon tank (3 pairs per tank)

Scissors

Construction paper - black, blue, red, yellow, green

Straws

Staple or glue

Stop watches or clock with a second hand

Audio or video tape of animal calls

Worksheets and pencils

Film - "Animal War, Animal Peace"

Home activities

ADVANCE PREPARATION

1. Secure an animal which will illustrate concepts of territoriality. In trial classes, anoles, a porcupine, bettas, cichlids, and ring doves were used to illustrate visual displays. Ferrets were used as examples

of an animal which employs scent marking. A video tape showing animals making territorial vocalizations and showing some of their activities was also used.

2. Become familiar with waterfowl at the zoo so that you will be able to assist participants in the interpretation of visual displays of the birds. Make copies of Worksheet 2: Descriptive Identifiers.
3. Order the film "Animal War, Animal Peace." One source is: University Of Minnesota Film Library, 3300 University Ave. S.E., St. Paul, MN 55414.
4. Using two 20-50 gallon tanks, set up three pairs of convict cichlids per tank several weeks in advance to allow them to establish territories.
5. Separate a pair of male and female ring doves from one another about a week in advance of this class.
6. Separate Siamese fighting fish into four small aquaria or plastic shoe boxes a few days in advance of the class.

TEACHING SUGGESTIONS

Home Activity Review (10 minutes)

Review the effects of environmental pressures on home-study animals. Ask "How did your animal behave in response to temperature, moisture, or habitat change?" See if there are new arrivals yet. Be prepared to discuss the care of young gerbils.

Getting Started: Discussion of Territoriality (15 minutes)

Objective: Given discussion and activities, participants will be able to explain what is meant by animal territories, the purposes they serve and the methods by which animals mark their territories.

Introduce the topic of territoriality by relating the concept of personal living space to territoriality. Explain that in certain homes, children have their own personal area which they consider theirs and brothers and sisters are expected to keep away. In other homes where children have their

own rooms, their room is sometimes considered their territory. Explain that many animals too, have territories. Ask, "Can you think of animals which have territories?" and follow this with other questions such as "Of what advantage is a territory to an animal?" "What activities take place in territories?" "Do all animals have territories?" "Give examples of animals that do not." "What means do animals have to mark their territories?" "What means do animals use to defend their territories?" Explain that aggressive behavior can be used to defend territories. Ask, "How do animals show this aggression?" Responses may include sounds, bearing of teeth, chasing, position of body, etc.

Demonstration: Scent Cues (10 minutes)*

Objective: Participants will be able to explain the value of chemical substances that animals produce in defining (i.e., marking) territories.

Ask, "What animals do you know that use a chemical means to mark territories?" Participants will suggest animals such as skunks, dogs, cats, deer, etc.

Gerbils have scent glands on the underside of their abdomen and deer mix urine with chemicals from scent glands to mark their presence. At this time have a member of the zoo staff show the participants an animal that has scent glands; ferrets and weasels are members of the Family Mustelidae, which includes the skunk, mink, and otter, and all of these have scent glands. The zoo staff member should relate any interesting information about the behavior of ferrets and answer any questions participants might have.

Activity 1: Auditory Cues (10 minutes)

Objective: Given materials and assistance, participants will be able to explain the value of vocalization in defining territories and identify some territorial calls of specific animals.

Explain that often sounds play an important part in letting other animals know that "this is my territory." This can be shown by playing an audio or video cassette which contains calls of 3 or 4 animals. In trial classes, calls of the gibbon, cougar, Indian mynah, and the blue and gold macaw were used. Questions to be asked might include, "What animal is making the sound?" or "How do these vocalizations assist the animal in establishing a territory?"

A songbird would be a good addition here; this would have good carry-over value next spring when local birds begin to vocalize.

Activity 2: Film - "Animal War, Animal Peace" (25 minutes)

This excellent film that depicts territoriality and aggression in animals can be shown at this time. Gulls, monkeys, the stickleback fish, and other animals are used to illustrate these concepts.

Discussion: Aggression and Territoriality (10 minutes)

Objective: Participants will gain an understanding of animal aggression and territoriality by discussing a series of questions.

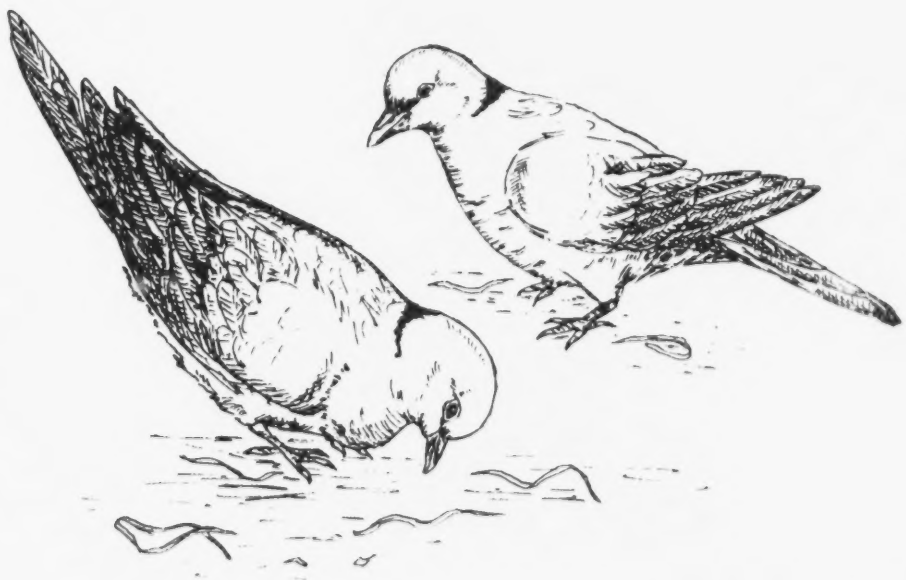
Discuss the following questions as they pertain to aggression and territoriality.

1. In what ways can aggression be helpful to an animal?
2. What are some situations in which you would expect an animal to be aggressive?
3. How could aggression be harmful to an animal?
4. What behaviors can animals use as alternatives to aggression?

Demonstration: Visual Cues in Bird Courtship (5 minutes)*

Objective: Through animal observation participants will be able to recognize specific animal displays.

Direct their attention to the ringed doves. The male and female ringed doves should have been separated a week in advance. By reintroducing the pair, participants are able to observe and identify both visual and vocal forms of communication. Record their observations of the ringed dove behavior on the board. Then ask, "How would you expect these behaviors to change when a strange male is put into the cage?" After participants make their predictions, place the additional male into the cage. Ask participants to observe carefully to see if the behaviors of the male or female ringed dove changes. Ask participants to give explanations for differences, if any, that occurred.

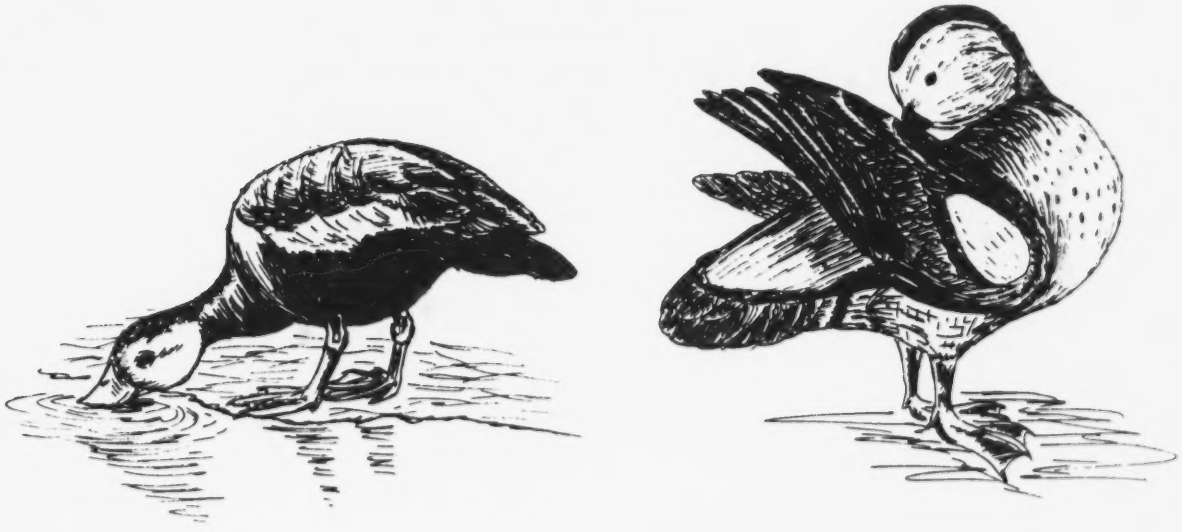


Display in Ringed Doves

Activity 3: Waterfowl Displays (40 minutes)

Objective: Participants will become familiar with basic waterfowl identification and learn to recognize simple waterfowl displays.

For further observation of visual cues, take participants to a waterfowl exhibit and have a keeper or curator assist in identifying waterfowl using a descriptive identifier approach. (See worksheet 2.) While participants are identifying waterfowl, the instructor looks for and points out various behavioral displays as they occur, i.e. courtship, aggression, territoriality, body maintenance.



WORKSHEET 2

SESSION 4

DESCRIPTIVE IDENTIFIERS: GIBBON ISLAND BIRDS

Bird	X if seen	"DESCRIPTIVE IDENTIFIER"
1. Mandarin Duck		Orange feet and bill, white eyebrow
2. Baer's Pochard		Black head
3. Garganey Teal		Chocolate brown head, broad white eyebrow, white patch at base of bill
4. Falcated Teal		White throat, dark crested head, spotted breast
5. Spot-billed duck		Yellow spot on tip of bill
6. Formosa (Baikal) teal		Vertical black line from eye to throat
7. Radjah shelduck		Black and white
8. Egret		White
9. Lesser flamingo		Pink
10. Philippine Duck		Blue bill, cinnamon on head, dark horizontal eye stripe
11. Plumed whistling duck		Buff colored plume on wing, light bill
12. Wandering whistling duck		Black bill, beige feather stripe on side, black cap
13. Red-crested Pochard		Red head

BETTAS & CICHLIDS

One normal threat display seen in Bettas and Cichlids is the front threat display:

normal

front threat

Watch for this display as we do activities with either or both of these two fish species.

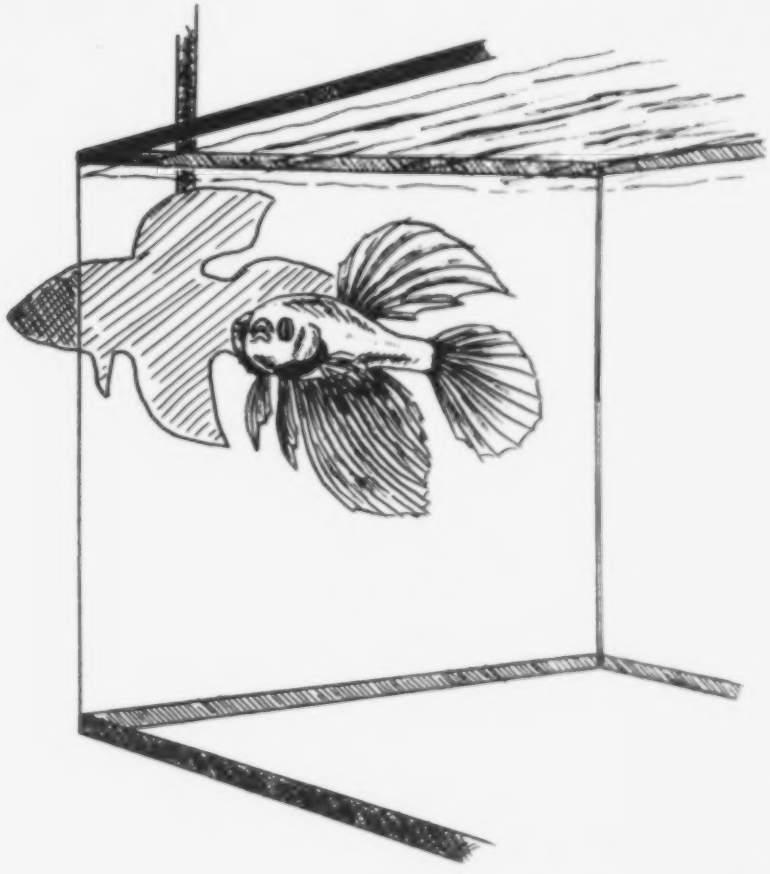
Activity 4: Aggression in Siamese Fighting Fish (25 minutes)

Objective: Given various stimuli and fish, participants will be able to determine which stimuli evoke aggression in Siamese fighting fish (Betta splendens).

Certain fish show aggression by changing color. Betta splendens (the Siamese fighting fish) is particularly useful for showing this phenomenon.

Have available several aquaria of Betta splendens. Begin by asking the participants, "What physical characteristics of the Siamese fighting fish trigger an aggressive display?" Responses could include color, size, shape, etc. Ask participants how they might find out. Tell them it may be possible to use paper models to find an answer to test these hypotheses. At this point, hand out worksheet 3. Have construction paper, scissors, straws, and staples available, out of which they will construct their models. The models should be stapled or glued to a straw in order to dangle them outside the aquarium near the betta. Tell them to keep records of which cues seem to be most effective in getting the bettas to display.

Then place two male bettas one in each of two aquaria (or plastic shoe boxes) side by side. Prevent the bettas from seeing one another by placing a cardboard "blinder" between the aquaria. Ask the participants to predict what will happen when the blinder is removed. When the blinder is removed, the bettas will change to a much more vivid color, will "stalk" one another, and will extend gill cover and fins. It is useful to have one of these demonstration set-ups for every two families. Ask the participants to describe to the whole class what they observed.

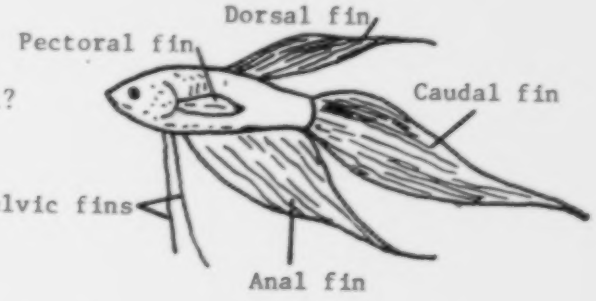


WORKSHEET 3

SESSION 4

SIAMESE FIGHTING FISH

Study the picture of the Siamese Fighting fish (Betta splendens) for a moment. Identify the location of the fins in describing the behavior of the fish.

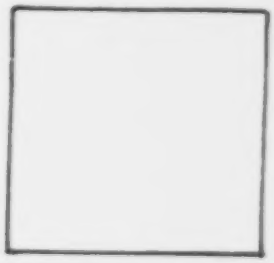


How is the fish behaving in the tank?

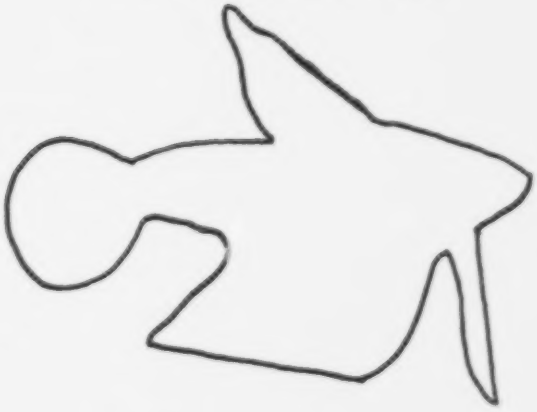
How would you describe its color?

Using black paper, cut out one of each of the following figures.

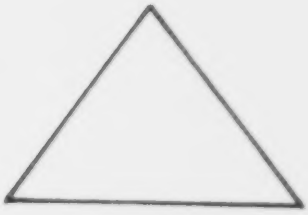
Non-displaying male



Square



Displaying Male



Triangle

A. Move the silhouette of the non-displaying male slowly up and down on the outside of the tank. Make your observations and then repeat using the silhouette of the displaying male.

How long did it take your fish to react to each?

Describe the color change, if any.

Did your fish react differently to the two silhouettes? How?

B. Move a silhouette of a square and a triangle slowly up and down on the outside of the tank.

How does the fish react to the square?

To the triangle?

Describe the color change, if any.

How does the fish react to the square and triangle as compared to the silhouettes of the Betta?

C. Remove the sheet between the two tanks. Observe carefully.

How long does the fish take to react?

Do both fish react at the same time?

Describe the behavior of the Bettas in response to each other.

Describe color change, if any.

Do the Bettas use certain fins more than others?

If so, which fins?

Besides the fins, what other body part(s) is/are used in the fish display?

What benefit could display behavior be to a wild Betta?

Activity 5: Territoriality in Convict Cichlids (30 minutes)

Objective: Given interpretive assistance, participants will identify the aggressive behavior of convict cichlids (Cichlasoma nigrofasciatum) that they exhibit in defending their territories.

Two tanks, each with three pairs of convict cichlids, (Cichlasoma nigrofasciatum) should have been set up and observed several days before this session. The albino variety of Cichlid seems to work better than the normal striped variety which sometimes tends to be too aggressive to show the territoriality concept. Begin the discussion by asking a question such as the following: "How many fish do you see?" Then have participants describe differences among them (size, coloration, etc.). See if they can distinguish the sexes. Ask the participants, "Do you see any indications of territoriality?" Responses might include chasing, body changes, etc., which should be immediately apparent. Have them observe the fish carefully to see if participants can identify the territory of each pair of cichlids.

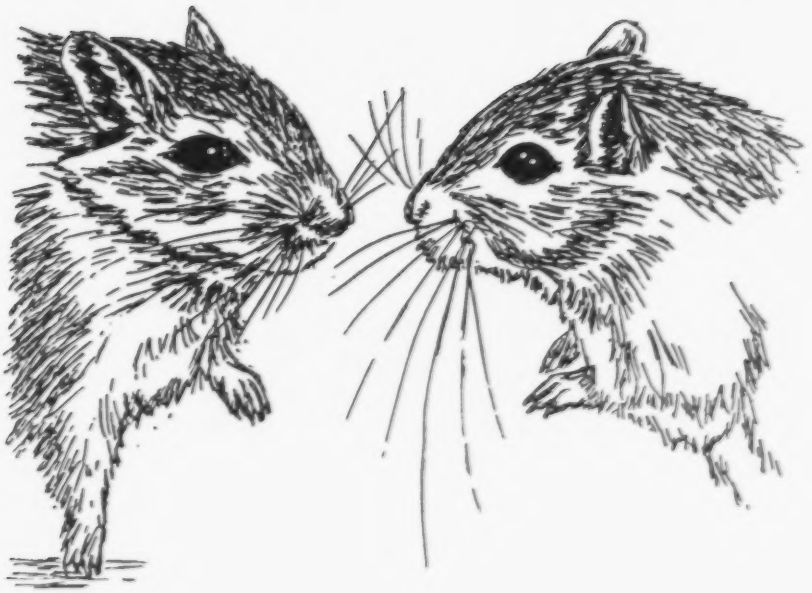
Home Activity (5 minutes)

Explain that next week participants will be demonstrating and/or showing the class the tricks they taught their gerbils and/or how quickly their gerbils are able to travel through the mazes the participants constructed.

Explain that next week they will be looking at the family structure and activities of primates. One of these groups is the Japanese snow monkeys (or a primate group located at your facility). Suggest that they bring binoculars to use.

HOME ACTIVITY

SESSION 4



AGGRESSION IN ANIMALS

This week in class we looked at aggression in various animals. We found that for different animals, aggression serves different purposes. For some, aggression helps them acquire food; while others may use aggression to acquire nesting or breeding territories. We also saw aggression used to maintain personal space.

1. In what ways might aggression be helpful to gerbils?

2. Describe the behaviors that your gerbils exhibit when one or both are being aggressive. Do males and females express aggression in the same way?

3. In some animals, especially among mammals, territories are marked by body scents. Hold your male gerbil so that you can examine his belly. Can you locate his ventral scent gland? He uses this gland to mark his territory. This scent acts as an olfactory threat (as compared to a visual threat display). Describe his movements when he is scent marking.

4. What other animals can you think of that scent mark or use scents in communication? Hint: Watch your own or your neighbor's cat or dog the next time you are outside. Or the next time you are at the Zoo, look for animals that scent mark.

Session 5

Social Structure of Primates

SYNOPSIS

During this last session, participants will explore and contrast the social structures of primate families (e.g., macaques, gibbons, baboons). A questionnaire is administered at the very end of the session. Each family will be given an opportunity to demonstrate the learned behavior(s) of their gerbils. Gerbils, cages and any other borrowed materials are returned on this day.

MATERIALS

Home Activity Questionnaire

Approximately 100 paper squares of construction paper; half red, half black approximately 3/4" square.

Approximately 100 paper squares of construction paper; half red, half black 1/2" square

Film - "Baboon Behavior"*

Worksheets 4 and 5

Certificates of merit

ADVANCE PREPARATION

1. Order film "BABOON BEHAVIOR", produced and distributed by the University of California, Extension Media Center, 2223 Fulton Street, Berkeley, California 94720; (415) 641-0460. One source is University of Minnesota Film Library, 3300 University Avenue S.E., Minneapolis, Minnesota 55455.
2. Cut out the paper squares described above.
3. Reproduce worksheets for primate study.
4. Make arrangements for curator or keeper to discuss primates and/or take the class behind the scenes.

TEACHING SUGGESTIONS

Home Activity Review (10 minutes)

Begin this class session by reviewing the home activity packet, AGGRESSION IN ANIMALS. Ask participants to share their comments, thoughts, ideas on what happened at home or what they learned about their study animal that they didn't know before. Specific questions about the home activity topic should be addressed here.

Discussion and/or Demonstration: Learning in Gerbils (30 minutes)

Objective: Given time and equipment, participants will be able to describe and/or demonstrate what their gerbils have learned.

a. Ask each family to describe and/or demonstrate the "trick" they taught their gerbil or the speed at which their gerbil travels through the maze that they built. Ask them to explain how they taught the gerbil its "trick" and/or to go through the maze.

b. Every family turns in gerbils, the maze, the cage, and the water bottle.

Getting Started: Discussion of Family Structure in Animals (10 minutes)

Objective: Given an explanation of family structure in animals, participants will give examples of these structures.

Begin the discussion by asking, "In what kind of family groups do you think gerbils live in the wild?" Gerbils are monogamous so one would expect to see a pair of adults and probably some young gerbils from their most recent breeding. Other animal species exhibit different social structures. Horses travel in herds with a dominant male (stallion), females (mares), and sub-adult males. Beavers are found living in pairs with their young from two seasons of breeding. Many big cats, such as the leopard, are solitary except for breeding; at this time the female will stay with the young until they are self sufficient, but the male may not be tolerated. Lions, on the other hand,

form extended family units called prides which might include "uncles, aunts, nephews, nieces", etc.

Activity 1: Family Units in Primates (15 minutes)

Objective: Given materials, participants will be able to predict and represent the family structure of the macaques and the gibbons (or of primates selected).

Give each family a variety of large and small squares of red and black construction paper. Use red to represent one sex, and black the other. Large squares to represent adults and small squares to represent juveniles and infants. Ask each family to predict and construct a model of the family or social structure for the primate groups they are about to observe. Ask, "Are they similar to gerbils or perhaps more like horses?" or, "Do these primates live in large groups, in single family units, or are they solitary?" When they have completed arranging the squares, diagram one of the models on the board. Ask families if they agree or disagree with the model that is on the board. What changes, if any, would they make? They will eventually check to see how accurate their predictions were. Additionally, you may wish to diagram a model of a human family.

Activity 2: Observation of a Primate Group (25 minutes)

Objective: Participants will be able to identify social behaviors in a primate group.

Begin this activity by visiting an appropriate primate troop. You will need to assist participants in determining the social unit and recognizing various behaviors that members of the group exhibit. Some questions you might choose to use are:

a. What are some of the anatomical or behavioral differences among the infants, juveniles, adult males, and adult females?

b. What interactions among individuals do you see?

c. Which animal do you feel is the most dominant in the group?

d. What family or social structure can you identify? Was the prediction that you made earlier accurate?

In preparation for Activity 4, you may want to distribute and begin answering the questions found in Worksheet 4.

Discussion: Primate Keeper Presentation (30 minutes)

Objective: Participants will be able to describe additional social behaviors and care of a primate group.

At this time have a curator or keeper lead a discussion about the primate study group at the exhibit. The keeper or curator should be prepared to answer detailed questions concerning the troop structure, care and maintenance and its natural history.

Activity 3: Observations of a Second Primate Group (30 minutes)

Objective: Participants will be able to describe the social behaviors of a second primate group.

Using the questions from activity 3, assist class members in determining the social structure of another primate group. If it is not possible to observe two different primate groups at your zoo, you may want to substitute a film of a second primate group. (We used a 20 minute film on "Baboon Behavior".)

Activity 4: Comparison of Two Primate Groups (15 minutes)

Objective: Participants will be able to compare and contrast the social behaviors of two species of primates.

After participants return to the classroom and/or watch the film, have them, as families, fill out Worksheet 4 to help them contrast the behavior of the baboons (from the film) with that of the macaques (at the zoo) or whatever primates you have used. Spend some time, after they have finished, answering the questions discussing several key points on the sheets. Inquire as to how closely their predictions of family/group structure actually matched what they observed.

On another occasion, the family structure in a macaque troop was compared to a single gibbon family using Worksheet 5 entitled "Social Organization". This handout can be easily adapted for pertinence to your zoo.

Final Evaluation (15 minutes)

Have each class member share what they enjoyed most about this course. Give out the final certificates of merit.

Worksheet 4

Session 5

JAPANESE MACAQUES/BABOONS

Compare and contrast the Japanese Macaques and the baboons from the movie "Baboon Behavior". It may be helpful to write down some of your answers to the following questions.

APPEARANCE

Baboons

Macaques

How do the Japanese macaques differ in appearance from the baboons in the film?

How are these two species similar in appearance?

How are we able to distinguish male baboons from females?

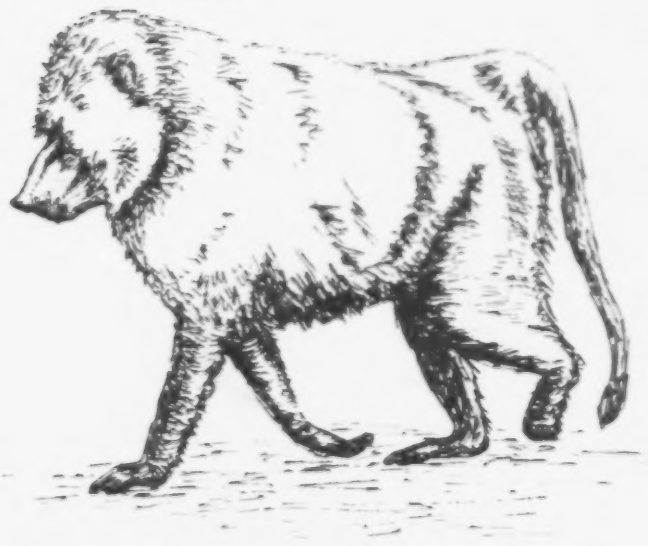
How can we distinguish male Macaques from females?

How can we tell infants from adults?

How can we distinguish infants from adults?

LOCOMOTION

Baboons



Macaques

When Japanese macaques walk, what is the sequence of foot placement?

What is the sequence of foot placement when they run?

How do infants travel?

How do infant baboons travel?

RESTING

Baboons

What positions would you expect an infant baboon to take when sleeping and resting?

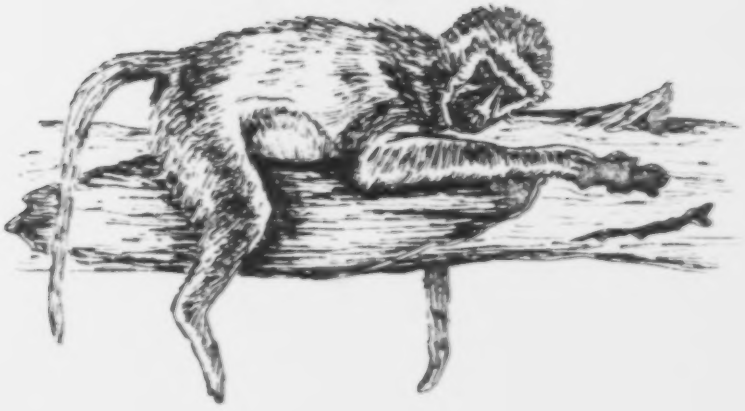
Macaques

Describe the sleeping and resting positions adult macaques take.

What positions would you expect an infant macaque to take when sleeping and resting?

How would you expect these postures to change if the air temperature were warm, as in the summer time?

Is this a picture of a baboon or a macaque?



EATING

Baboons

How do baboons use their hands when eating?

Macaques

What foods do macaques eat?

How do macaques use their hands when eating?

Do macaques clean grit off of their food?

What foods do infant macaques eat?

Do macaque parents feed their young?

THE TROOP

Baboons

In what situation would you expect a baboon troop to bunch closely together?

What situations would cause the troop to spread out?

Macaques

In what situation would you expect a macaque troop to bunch closely together?

When would the troop be spread out?

What influences do differences in habitat have on aggregation and dispersion (closeness and spacing) in Japanese macaques as compared to the baboons in the film?

What effects would you predict these differences in habitat to have on the amounts and kinds of aggressive behavior in troops of these species?

DRINKING

Baboons

Macaques

How are the body positions and movements of drinking macaques similar or different from the positions and movements of baboons?

Describe the body positions of baboons when they are drinking.

Worksheet 5

Session 5

SOCIAL ORGANIZATION

Observe the macaques and gibbons each for a 20-25 minute period.

Macaques

Gibbons

Macaques

1. Observe the behavior of the macaques. List 5 behaviors associated with the social organization of the troop.

   a.

   b.

   c.

   d.

   e.

2. Describe the dominant (sometimes called the Alpha) male and his activity.

3. Look closely at the grooming behavior of the macaques. Describe this behavior in detail.

4. Describe the interaction between a mother and her baby. Do other monkeys interact with either one? If so, describe.

5. Measure and record the amount of time two individuals in the exhibit spend grooming.

Gibbons

1. Observe the behavior of the gibbons. List 5 behaviors you observed, that you believe have to do with the social organization of the gibbons.

   a.

   b.

   c.

   d.

   e.

2. Why are there so few gibbons on the island?

3. Observe and describe the grooming behavior. What is the advantage to the gibbons from this activity?

4. What benefits might there be to living in small groups containing only a few family members?

5. Can you describe differences in male and female roles? If so, describe.

APPENDICES 1-5

APPENDIX 1

p. 6 Activity 4: Seeing the Zoo

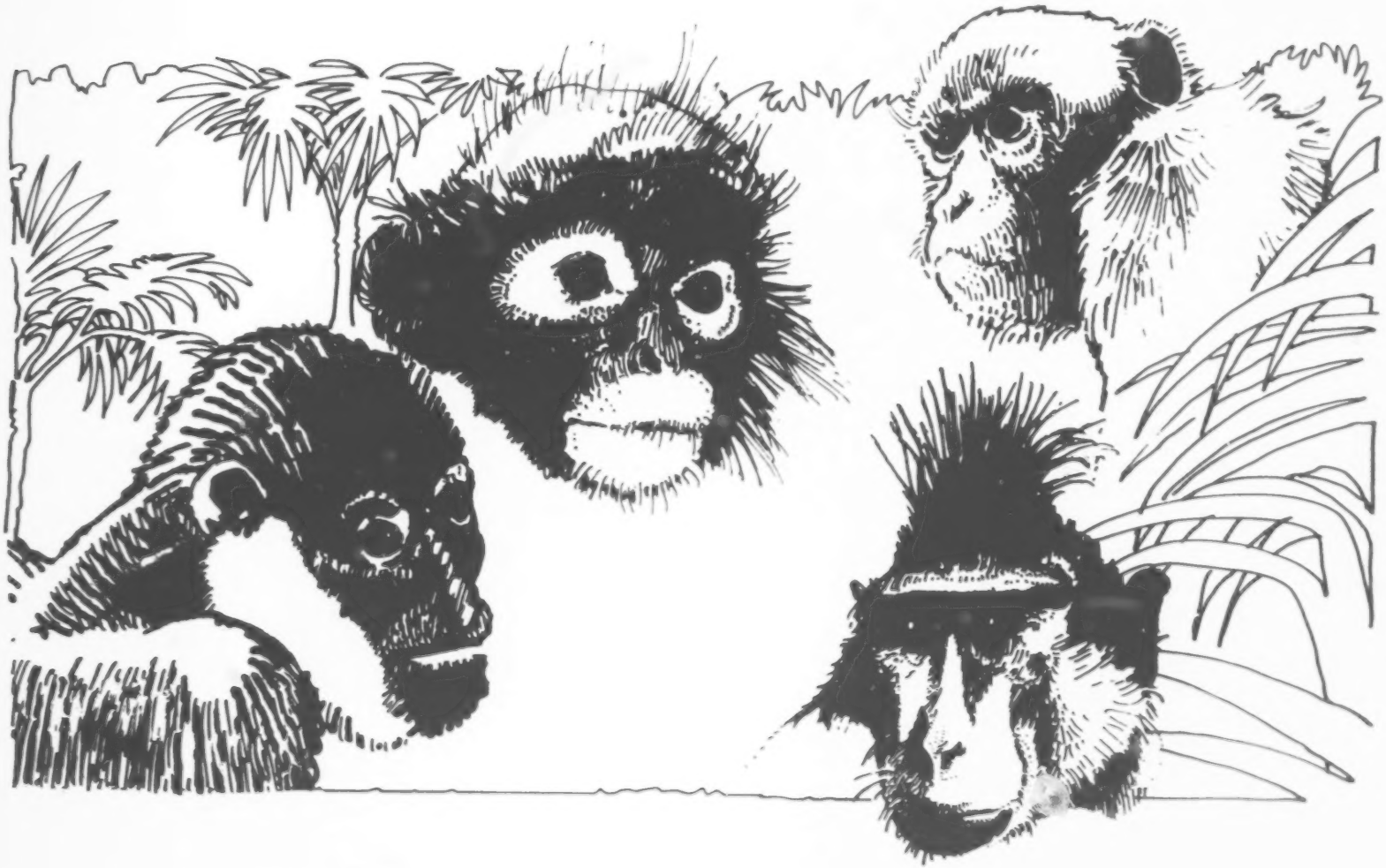
An alternative activity developed at the Minnesota Zoo are a series of Discovery Cards (see sample enclosed). These cards are designed to both stimulate observation and provide a fun learning experience. Participants are asked to make animal observations and decide which, from a series of drawings, best represents targeted animals. You can easily develop a similar sheet pertinent to your situation.

p. 6 Activity 5: Meeting Your Gerbil

Not all zoos will be using gerbils as study animals, so at this time participants may wish to generate questions or answers pertaining to their animal. Should you be using animals from home (not brought into the zoo) such as a dog or parakeet, time could be spent outlining a daily care and attention sheet for your animal. Look up some history and/or facts about your animal and prepare to share with class next session.

DISCOVERY CARD 6

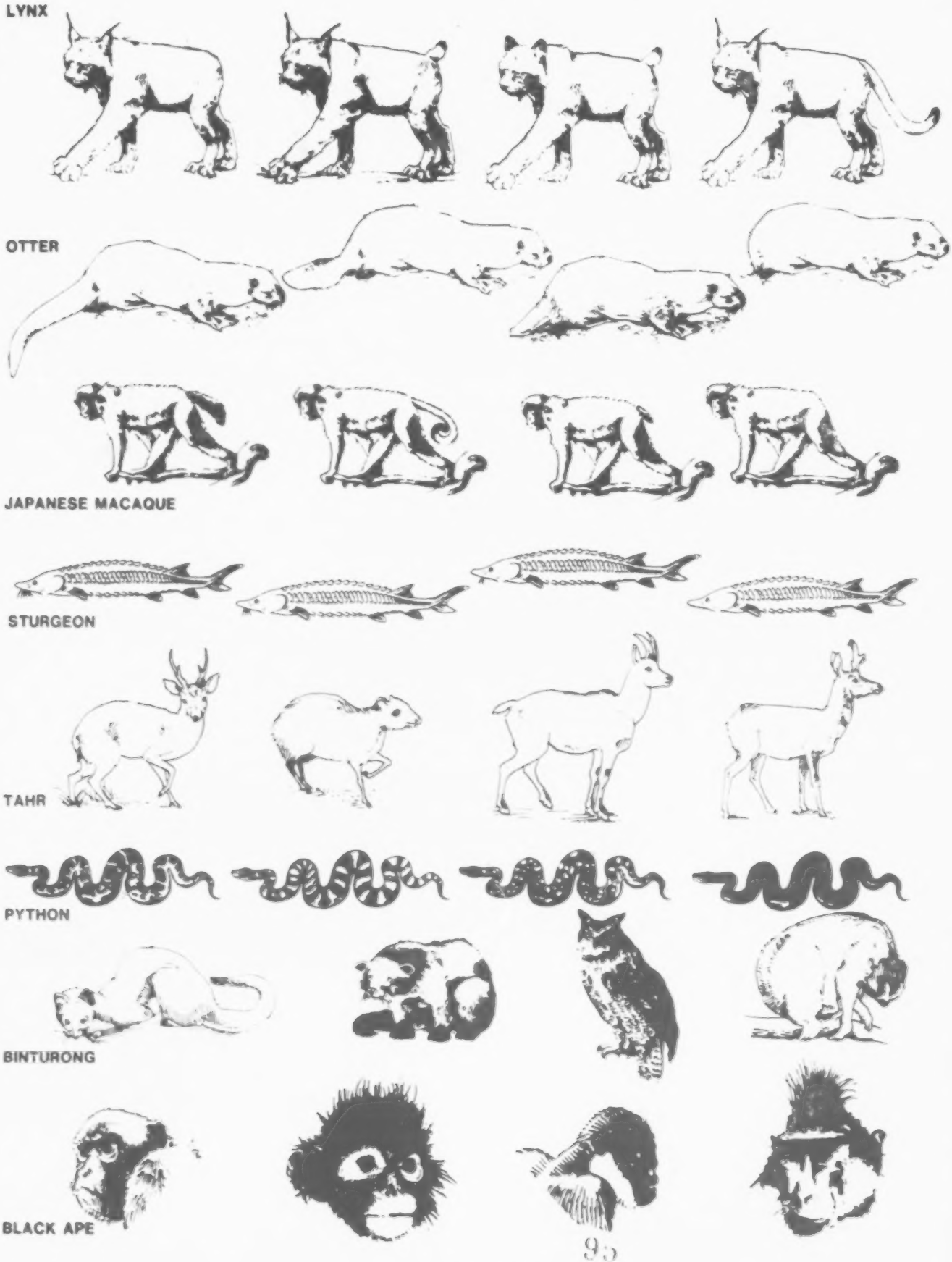
NOVICE OBSERVER



DIRECTIONS: As you view each animal, circle the correct drawing.

These animals are found on trails: 2 3 4

© 1981, Minnesota Zoological Garden


LYNX
OTTER
JAPANESE MACAQUE
STURGEON
TAHR
PYTHON
BINTURONG
BLACK APE

APPENDIX 1

p. 7 Home Activity Packet Alternatives

Home activity packets 1, 3 and 4 are readily adaptable for most study species. Activity 2 has been modified for the following: fish, birds, dogs, rodents.

A. FISH (goldfish, cichlids, guppies, bettas)

Behaviors which can be taught to fish include:

1) conditioned to feed when aquarium light is turned on
2) feeding in response to whistle stimulus
3) ringing a bell for food
4) swim through hoop for food and then jumping through hoop for food

B. BIRDS (parrot, cockatiel, canary, parakeet)

Behaviors which can be taught include:

1) finger training (be able to sit and be carried on a finger or hand)
2) perform a "trick" (postural movement)
3) bird flying to you on command
4) vocalizing on cue (pre-conditioned stimulus talk or whistle)

C. RODENTS (mice, rats, hampsters)

1) see maze learning in gerbil form in home activity #2

D. DOGS

Behaviors which can be taught include:

1) obedience to commands (fetch, sit, stay, heel, come, lie down, retrieve)
2) tricks (roll over, speak, beg, open door, ring bell for food)

E. ANNOTATED BIBLIOGRAPHY OF CLASSROOM ANIMAL CARE AND BEHAVIOR

In all the above conditioning examples, rewards are all food orientated, but response such as pat on head or a verbal compliment have also been known to be effective.

E. ANNOTATED BIBLIOGRAPHY OF CLASSROOM ANIMAL CARE AND BEHAVIOR

1. A Zoo in Your Room. Caras, Roger. New York: Harcourt, 1975; cl. Most of the animals covered are housed in aquaria/teraria (eg. amphibians, fish, insects) with the exception of birds. It is simply written without too many details.

2. Activity Wheels. (Teachers Guide For Animal Activity). McGraw Hill, ESS, pap. (4-6). Includes instructions on how to build a wheel plus some investigations students may want to conduct with the rodents. A sample experiment is also provided.

3. All About Chameleons and Anoles. Roberts, Mervin F. New Jersey: T.F.H. Publications Inc., 1977. This small paperback doubles as a sort of field guide/ natural history book and guide to catching and caring for these types of lizards. There are many color prints to aid in identification; it is very easy to read.

4. Animal Care From Protozoa to Small Mammals. Orlans, F. Barbara. Menlo Park, California: Addison-Wesley, 1977. An excellent book covering all the common classroom animals. Includes far more than just care including behavioral observations, activities, and breeding. Pap.

5. Animals in the Classroom. A guide for teachers. Elementary Science Study. New York: McGraw Hill. Pap. Deals mainly with desert animals and gerbils. Explains culture techniques, care and propagation and things to observe.

6. Behavior of Mealworms. ESS. McGraw Hill, (6th grade). Explains many experiments that can be done which effectively demonstrate important mealworm behaviors (eg. smelling, locomotion, vision, etc.) Pap.

7. Brine Shrimp and their Habitat: An Environmental Investigation. National Wildlife Federation. Geared for the elementary classroom, it provides instructions on hatching shrimp, behaviors to observe and experiment with, and background information on the animal itself. Pap.

8. Brine Shrimp: Observing the Life Cycle of a Small Crustacean. ESS (1-4), McGraw Hill Science Module. Similar to above but with more emphasis on life cycle than behavior. Pap.

9. Care of the Wild, Feathered and Furred: A Guide to Wildlife Handling and Care. Hickman, Mae and Guy, Maxine. Unity Press, California, 1973. The first part of the book deals with particular common, wild animals and how to care for them, and the second part gives instructions on how to deal with particular types of wounds and diseases from BB shots and oil cleaning to rabies. Pap.

10. Crayfish: Investigating the Behavior of a Freshwater Animal. McGraw Hill Science Module (4-6). Pap. Emphasis is on behavior with a minimum of experimental (outside) influences. Includes instructions on care of crayfish in the classroom. Many suggestions of questions children may ask.

11. Culture Methods for Invertebrate Animals. Needham, James, ed. New York: Dover, 1959. Excellent collection of articles on the subject. Usually several examples of culturing for each species mentioned.

12. Discovering What Goldfish Do. Simon, Seymour. New York: McGraw, 1970, cl. This is a very good book for children (about 8-12) on how to raise goldfish, some basics on their anatomy, behaviors they readily exhibit and simple experiments they can be used for. Excellent for the elementary school classroom.

13. Encyclopedia of Reptiles and Amphibians. Breen, John F. New Jersey: T.F.H. Publications, 1974. Cl. Very well illustrated with photographs of most of the animals covered. Primarily geared toward habitat and care in captivity, including how to capture the animals in the wild.

14. Experiments in Animal Behavior. Hainsworth, Marguerite D., Boston: Houghton Mifflon, 1968, cl. Description of possible experiments that can easily be replicated in the classroom. Range is from a simple light/dark reaction in amoeba, to conditioned learning in rodents and schooling in fish.

15. Guidelines for the Breeding, Care and Management of Laboratory Animals. National Academy of Sciences. Washington, D.C., 1974. This is a series of books with precise guidelines on the care of animals in a lab. It includes information on which animals are best to use and state regulations regarding their capture. It is written for the scientist or science teacher, not the student. Pap.

16. Humane Biology Projects. Animal Welfare Institute. (9-12). The purpose of this pamphlet is to give ideas on studying life without the addition of pain, distress, and especially, death. Several behavioral experiments are discussed using mammals, birds, insects, and fish. There are also sections on physiology, botany and genetics. Pap.

17. Insects As Pets. Villiard, Paul. Garden City, N.Y.: Doubleday, 1973. Provides clear and simple instructions on housing and raising common insects. Apparatus are designed for visibility so that behavior may be observed. Cl.

18. Keeping Reptiles and Amphibians. Leutscher, Alfred. Newton Abbott, Devon, England: David and Charles, 1976. cl. Many of the animals mentioned here are more exotic than what one would normally find in a classroom. Those presented, however, are given more of a natural history description than most books on care.

19. Raising Wild Ducks in Captivity. Hyde, Dayton O. (ed.). New York: Dutton. 1974. cl. Everything from obtaining ducks and eggs in the first place, to detecting diseases in them; from egg turning to duckling imprinting. Although the book can get pretty sophisticated most of it can be simplified to fit your purposes.

20. Teachers Guide for Earthworms. ESS, McGraw Hill. (3-8). Pap. This can be adapted to a range of grade levels as it includes simple activities like collecting, caring for, and observing the earthworms as well as experimental projects for upper level students.

21. Nutrient Requirements of Domestic Animal Series: Nutrient Requirements of Dogs #8, 1974. National Academy of Sciences, Washington, D.C.

22. Nutrient Requirements of Laboratory Animals. 1978. 3rd. revised edition.

23. The UFAW Handbook on the Care and Management of baby animals. 5th. edition.

24. Pets, by Frances N. Chystie. Little, Brown & Co. 1964.

25. Great Pets, by Sara Stein. Workman Publishing Co., Inc. N.Y. 1976.

26. The Dog Its Domestication & Behavior. 1978. Michael W. Fox. Garland Publishing, Inc.

Numbers in parentheses (eg. (308)) refer to grade level.

Cl.--cloth
Pap.--paper

APPENDIX 2

p. 21 BACKGROUND INFORMATION

Behavior is the way an animal acts. Through both natural selection, which leads to adaptive evolution, and individual learning, which enables individuals to cope with local details of their environments, animals acquire behaviors that adapt them to their environments.

Instinctive Behavior: Some behaviors are so essential for animals to survive that they have become genetically programmed. Examples might include the holding of their breath by marine mammals, the homing instinct, and the nursing instinct.

Natural Learned Behavior: Although animals may be adapted physically to special environments, many necessary survival behaviors are learned either from their parents, through play behavior with siblings, or through exploration activity by the individual animal. An animal's naturally learned behaviors depend on imitating, experimenting, and then practicing (trial and error learning). Whether or not a behavior is repeated is dependent on how rewarding it is. Many animals are extremely curious and find new objects and experiences challenging. Often new behaviors are initiated as a game. If the animal is rewarded by catching something to eat, or with the pleasurable experience of having others join in, the behavior will be repeated and a new behavior will have been learned.

Sometimes natural behaviors persist in an artificial environment even in the absence of any classical reinforcement. Have participants consider the digging behavior of gerbils, especially digging at the plastic of their cages. Behavioral pathologies can and do develop from mis-matches between the animal's inherited mechanisms and the world with which it has to cope.

Trained Behavior: This behavior is an extension of natural learning. In their natural environment, there is neither the necessity nor the opportunity for a marine mammal to learn many of the complex behaviors performed by trained animals. However, within the limits of its physical and mental capabilities, these complex new behaviors can be taught by extending the animal's natural learning processes.

APPENDIX 2

The same principles of reinforcement of behavior, through use of rewards or by the absence of rewards, are the key to behavioral training used by zoo staffing in training zoo animals. The purpose for most training of animals in zoos is to give animals sufficient exercise and challenge, which is sometimes lacking in their smaller confines.

p. 23 Activity 2: Trained and Conditioned Behavior

We realize not all zoos have a dolphin show or bird show, but most animals (if not all animals) in a zoo or captivity are conditioned to behave or react to certain stimuli. Substitute a seal or elephant show for an event, talk about and visit exhibits when food is to be presented.

How do they make it through the winter?

BY ANNE LaBASTILLE

DAY and night, the winter winds of 1977 blasted my log cabin in upstate New York. Arctic air leaked through the chinking. The seemingly endless snowfalls threatened to bury the cabin or buckle the roof. My woodpile sank lower and lower. But if my own devices for survival seemed puny in the face of such a season — the coldest on record for most of the country — what of the wildlife outside? I knew some individuals would not make it, despite their marvelous winter adaptations. What I could not have known, then, was how high the final toll would be.

- Millions of fish suffocated in the Midwest as shallow lakes became so thickly iced that oxygen was cut off.
- Wild turkeys in Pennsylvania were forced to follow deer, seeking leftover acorns that the larger animals were able to dig from the snow.
- Long-tailed birds, such as pheasants, starved when their tails became iced to the ground.
- Dozens of sea turtles were found frozen stiff but still alive along the coast of Florida.
- Thousands of waterfowl died in New Jersey when the ice covered their plant food.
- Blue crabs and shrimp in the Atlantic Ocean were killed by the winter chill of the water.
- Trout eggs and aquatic insect larvae were destroyed by the scouring action of bottom ice.
- Carolina wrens were decimated throughout most of the Northeast because the food they depend on was snowed under.

The wonder of it all was that there were any creatures left by the time spring finally came. As it turned out, of course, I thrilled once again to the sights and sounds of wildlife thriving all around me in the Adirondacks. True, it had been an unusually severe winter. But in the greater scheme of things, it was just another interruption. After millions and millions of years on earth, wildlife has learned how to cope with such interruptions.

In the most simplistic sense, animals survive bitterly cold weather in one of two ways. If they're lucky, they can migrate away from it — go where it's warmer. If they are not so fortunate, then they must stay and tough it out, each species in its own fashion.

Fully two-thirds of the birds in the northern U.S. and Canada escape the cold by flying to the Deep South, Mexico, Central America or farther. But migration is not reserved solely for birds: monarch butterflies and many other insects journey over well-established flyways. Several kinds of bats also head for the tropics or subtropics each fall. Many of the baleen whales, including the humpbacks, depart frigid arctic or antarctic seas for warmer, ice-free waters.

But what about all of the creatures that stayed behind in the harsh winter of 1977? These are the animals that undergo another set of changes. For some, there is the "little death" of hibernation, a trancelike state that is the ultimate in energy conservation. Many frogs, turtles and toads overwinter by burrowing into the mud bottoms of lakes and swamps. Snakes hole up in rocky dens, sometimes in great numbers, piled around like so much spaghetti.

In the fall, woodchucks, ground squirrels and other hibernators begin slowing down. They stop their frenetic gorging and laying-on of fat to laze in the sun. One day their body heat begins to drop, hour by hour, until their body temperature nears freezing. The heartbeat slows, blood pressure plummets and magnesium and a chemical called noradrenaline increase throughout the animal's system. These chemical changes effectively anesthetize the creature and cut the clotting time of its blood so that a wound sustained by a hibernator would scarcely even bleed.

The ground squirrel offers a striking example of the changes that occur: this hyperactive little mammal becomes virtually inanimate. Its respiration slows from 100 breaths per minute to 4. Its heartbeat goes from about 250 beats per minute to 10 and its body temperature crashes from 97 degrees Fahrenheit to 39 degrees.

Another very active creature, the jumping mouse, has some further refinements and apparently is able to control the length of its hibernating period. Recent research done in Utah by Jack Cranford of the University of Utah indicates that jumping mice have varying periods of hibernation at different elevations and seem to be able to respond to soil temperatures rather than air temperatures — the higher up, the colder the soil, hence the longer the hibernation.

In the spring, reawakening occurs with astonishing swiftness. In marmots, for example, body temperature may rise 35 degrees within an hour. The ground squirrel's temperature climbs from 39 degrees back up to its normal 97 degrees in about four hours — roughly the time it takes for the animal to stir, open its eyes, make its first movements and then crawl out the entrance of its den.

Another way of getting past winter's ordeals is in a torpor, or dormancy. This is a deep sleep rather than hibernation and the animal's body temperature usually remains closer to normal, though breathing and circulation do slow slightly.

Dormant animals like chipmunks, striped skunks, opossums, raccoons and black bears can easily wake up on mild days every few weeks. They sally forth to feed, defecate and even mate in late winter.

Late one January, I almost literally stumbled onto a bear's den. I was

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snowshoeing through a balsam thick-

The cold air was dead calm — one those days when the smoke rises straight up from chimneys and smokestacks. Suddenly, I stopped dead, then backed slowly away. Right there in my path, the faintest wisp of steamy air was rising from a mounded snowbank. If I hadn't noticed it, I might have crashed in right on top of the bear that slept there. A bear doesn't take kindly to being abruptly awakened — particularly if it's a female that, during her torpor, has given birth to two tiny youngsters!

In lieu of snug dens, other animals depend almost entirely on their own physical adaptations to get through winter. Many birds and mammals grow longer, thicker plumages and pelts. The hollow guard hairs of the caribou and deer hold dead air close to the skin, which makes for super insulation. The woolly undercoats of arctic foxes trap an extraordinary amount of air, a most energy-efficient insulator. In fact, this northern fox can sleep outdoors at minus 40 degrees without undergoing cold stress.

STILL other insulating methods are used by birds. For example, chickadees and blue jays fluff out their feathers until they look like colored Christmas balls perched on bare branches. Wolves and coyotes use a similar tactic, puffing their hair out and curling into tight balls with their tails over their faces. Still other animals beat the cold by shivering and huddling together.

"Acclimatization" to winter also means internal changes, even for nondenners. Blood chemistry, blood pressure and circulation all change. More blood may be pumped to the paws, ears, tail and nose, where the extra warmth is needed. Because of such changes, the red fox can stand winters that are almost 100 degrees colder than the usual summer temperatures in their home range.

A fascinating major research investigation of seasonal adaptations of white-tailed deer is being completed by Aaron N. Moen, an associate professor of wildlife ecology at Cornell University. Moen has been studying the reactions of whitetails to their environment for the past 15 years. Deer in his laboratory herd, kept in a large pen, are at ease with humans and accustomed to wearing tiny radios. These radios transmit electrocardiograms, and over 3,000 hours of measurements have been made on these penned deer. While the deer are transmitting heart-rate information, they are observed with binoculars and their behavior related to heart rates. Because of the gentle treatment the deer receive, they have natural reactions to changes in weather and seasons rather than to stress because of being penned.

Moen's work has revealed that the deer employ a most interesting and useful strategy during the winter: they exhibit true energy conservation. He compares it to cutbacks in spending by people who are short of money: deer balance their *inner* resources with those available from the *outer* world. In wintertime, deer often move into coniferous cover on level bottomlands. They concentrate on smaller and smaller areas. They move slower and forage less. They appear to be more lethargic. There is a similarity between this response and hibernation, although deer do not go to the extremes that woodchucks and other hibernators do. But the deer do conserve energy, and many of their body functions, including thyroid activity — which regulates metabolism — drop to seasonal lows. There is a definite "metabolic depression."

Any disturbance of deer in winter, such as by snowmobiles or packs of dogs, goes against the deer's energy conservation plan. Deer observed in winter may even *appear* to be unperturbed by disturbances, but their hearts are likely to be beating at a fast pace and limited energy reserves are used up unnecessarily. This could prove fatal in hard winters.

Moen's research should result in a stronger biological argument for the management of deer in winter: allowing animals in winter-concentration or "yarding" areas to remain as undisturbed as possible. This may also mean better control of snowmobile traffic and free-ranging dogs, coupled with maintaining as much natural food and cover as possible for deer, year-round.

Despite all the strategies for winter survival, animals do die and sometimes perish in great numbers, as last winter showed. Freezing to death is common, and happens in animals much as it does in humans. First the limbs chill and may become frostbitten. Then cold stress, or hypothermia sets in. The body's core cools, the brain becomes sluggish. Drowsiness and confusion follow. Next, the pituitary-adrenal system breaks down. Then comes death.

The big brown bat is a case in point. Unlike several of its relatives, who hibernate in parts of caves that stay steadily above freezing, the big brown sometimes waits out the winter upside down in old buildings or hollow trees. The bat can hang next to icicles and survive, but if a cold wave moves in swiftly, this flying mammal can be killed before it is able to wake and warm itself by body chemistry and moving around.

Freezing is not the only way wildlife dies in winter. Fish in shallow ponds can suffocate when ice is covered by heavy snow that blocks sunlight, kills aquatic plants and thereby cuts off the production of oxygen by photosynthesis. In Wisconsin last winter, the natural resources department managed to save about 500 choice hybrid muskies in one lake by bringing in pumps and aerating the water, a rescue technique that is often used.

The cruelest death of all is starvation. This happens fairly often among deer, particularly whitetails. On snow-shrouded Tug Hill in New York last winter, nine feet of snow lay on the level for months, and a total of 35 feet of snow fell. Deer were completely imprisoned and unable to browse. To top it off, roving groups of feral dogs moved in and attacked the weakened animals. Those creatures' fat deposits had been used up and their bone marrow had turned red and gelatinous. As many as 85 percent of the deer in some parts of the region are believed to have died.

But hard winters are not all bad. Biologically speaking, they act like a dose of salts, cleaning out the sick, crippled, injured and aged individuals. Overpopulations can be cut back down to size for a proper balance with the existing food and habitat. In this way, an occasional severe winter can rejuvenate a wildlife population.

No winter is all "good" or "bad" in human terms. U.S. Fish and Wildlife Service biologists agree that the winter of 1977 will definitely have an adverse impact on much of our hunting and fishing, birdwatching and wildlife photographing for the next one to five years. Yet, in the long run, wildlife will go on living.

Writer Anne LaBastille is an Adirondacks guide and an international consultant on environmental concerns.

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APPENDIX 4

p. 48 Demonstration: Scent Cues

While families are seeing the demonstration of the ferret in one area, "scent mark" a territory in another area using a freshly cut onion, thereby laying out a predetermined territory. Families are brought into the room and given the following challenge, "Diagram the classroom and, using your nose, determine the boundaries of a 'marked' territory which I made by using a cut onion." Ask, "In what ways is being able to detect a scent an important ability for an animal to have?"

p. 51 Demonstration: Anoles Lizards

Separate four anoles into four small aquaria or plastic shoe boxes a few days in advance of the class.

An alternative activity to the previous one is to use anoles lizards which display aggressive behavior by lowering its dewlap. In trial classes, we have placed two aquaria (or plastic shoe boxes) side by side (each housing a healthy male anole) separated by an opaque blinder. Each anole had been in his aquarium alone for several days and had established a territory. Ask the participants to predict what will happen when the blinder is removed. When the blinder is removed, the anole perceives a "challenger" to his territory. This should cause a lowering of a dewlap and/or other visual displays (pumping and narrowing of the body, bobbing of the head, etc.). It is important to have a second set of aquaria as a back-up in case the first set of anoles do not display aggressively.

APPENDIX 4

APPENDIX 5

Alternate primate behavior films available from: University of Minnesota
Audio/Visual Department
3300 University Ave. S.E.
Minneapolis, MN 55414

750803	Miss-Goodall and the Wild Chimpanzees
1R0119	Monkeys, Apes and Man
7N0701	Primates: Diversity of Animals
7N0757	Primates: Animal Secrets
5N0816	Baboon Social Organization

Post/Zoo Parent Name_____

1. On the following scale, how would you rate this course?

Very Poor — Poor — Fair — Good — Excellent

2. Comment on one particularly rewarding experience you have had as a result of the course.

3. Comment on one particularly frustrating experience you have had as a result of the course.

4. Would you recommend this course to your friend?

Yes_____ No_____

5. Did you like taking the course with your child(ren)?

Yes_____ No_____

6. How would you rate the following parts of the course?

	Very Poor	Poor	Fair	Good	Excellent
Class Activities					
Home Activities					

7. If other courses in animal behavior like this one (on different topics) were offered, would you take them?

Yes_____ No_____

8. Would you rather take courses like this with a friend or with your child?

_____With a friend

_____With your child

9. Try to list three things you liked about this course.

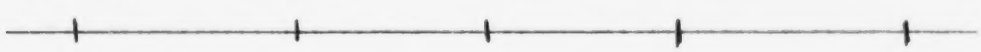
10. Try to list three ways the course might be improved.

11. What did you find out about your child(ren) that you didn't know before taking this course?

Post/Zoo Child Name_____

1. On the following scale, how would you rate this course?

Very Poor Poor Fair Good Excellent



2. Comment on one particularly rewarding experience you have had as a result of the course.

3. Comment on one particularly frustrating experience you have had as a result of the course.

4. Would you recommend this course to a friend?

Yes_____ No_____

5. Did you like taking the course with your parent(s)?

Yes_____ No_____

Why?

6. How would you rate the following parts of the course?

	Very Poor	Poor	Fair	Good	Excellent
Class Activities					
Home Activities					

7. If other courses in animal behavior like this one (on different topics) were offered, would you take them?

Yes_____ No_____

8. Would you rather take courses like this with a friend or with your parent(s)?

_____with a friend

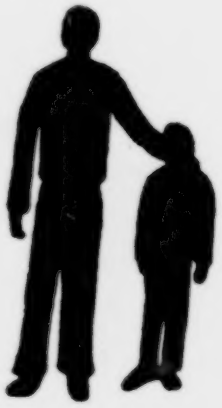
_____with your parent(s)

9. Try to list three things you liked about the course.

10. Try to list three ways the course might be improved.

11. What did you find out about your parent(s) that you didn't know before taking this course?

Shared Learning Experience in Science



This is to certify that

_____

has completed

_____

at the _____

Signed: _____

Date: _____